Financial crises

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Financial Crises: Impact on Central Bank Independence, Output and Inflation

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Chapter 1

Introduction

1.1 Background and Motivation

The recent financial crisis, which originated in the US, has spread to the rest of the world. The impact of the financial crisis on economic activity varies widely across countries, reflecting differences in exposure and vulnerability to financial crises, and heterogeneity in macroeconomic structures, and differences in policy responses (Berkmen et al., 2009). Although several reasons have been put forward to explain cross-country differences in the impact of the crisis, so far the potential role of labor market flexibility has been neglected.

Another issue that has attracted a lot of attention is the interaction between monetary and fiscal policy during the crisis and its implications for central bank independence. Many central banks over the past years have engaged in policies that have clear fiscal dimensions, including credit provision to the private sector, bailouts of financial institutions, and quantitative easing involving the purchase of risky mortgage backed securities and long-term treasury securities. In addition, some anecdotal evidence suggests that financial crises may threaten central bank independence. For instance, the central bank governor in Argentina was dismissed in 2010, because he refused to use

currency reserves to pay off foreign debt. Similarly, Mexico's president appointed a new governor for the Bank of Mexico in 2009, after he clashed with the bank's former governor who was reluctant to cut interest rate after the country was hit by the crisis.

Up to now, there is hardly any research examining the relationship between financial crises and central bank independence. Since the independence of central banks increased both in industrial and emerging countries during the last two decades, in almost all discussions of central bank independence it was taken for granted that a suitably independent central bank could achieve its inflation targets. An influential study of Rogoff (1985) suggests that central banks should be independent to deal with the inflationary bias due to the time inconsistency problem (Kydland and Prescott, 1977). However, Sargent and Wallace (1981) show that when fiscal policy fails to set the present discounted value of primary fiscal surpluses right, it will force a central bank to generate the seigniorage necessary to balance the budget. Hence, price stability may be threatened if fiscal policy is not sustainable.

Several recent theoretical papers, like Davig et al. (2011) and Davig and Leeper (2011), suggest that even if a central bank is operationally independent from government, in an economy facing a debt crisis and reaching its 'fiscal limit', i.e. a point beyond which tax collections can no longer rise and government expenditures cannot be further reduced, the central bank will be forced to sacrifice its inflation target to stabilize government debt by money creation. Walsh (2011) also suggests that there is a need for coordination between monetary and fiscal policy during financial crises, as central banks risk political exposure.

This dissertation aims to examine the impact of financial crises on central bank independence, output, and inflation. Firstly, we discuss the measurement of central bank independence. Most studies on central bank independence (CBI) use either an indicator based on the central bank law in place, or an indicator based on the so-called turnover rate of central governors. The most widely employed legal CBI index is from Cukierman (1992) and Cukierman et al. (1992), although alternative measures have been developed

(see Arnon et al. 2006). However, CBI indicators based on the central bank law in place tend to be static and cannot capture institutional and economic factors that affect the actual independence of the central bank (Cukierman, 2007). Hence, in Chapter 2 of this dissertation, we construct both a legal and an actual index of CBI for the central bank of Indonesia, Bank Indonesia (BI), since its creation in 1953 until 2009. The first research question we deal with is how the legal and actual independence of BI has developed since its creation? We also examine the relationship between CBI and inflation in Indonesia.

Secondly, we examine the impact of the current financial crisis on output and unemployment by considering the role of labor market flexibility. Forteza and Rama (2006) report that countries with relatively rigid labor markets experienced deeper recessions and slower recoveries. However, theoretically, the relationship between output loss and labor market flexibility is not clear. On the one hand, Keynesians argues that a flexible labor market is "bad" because it increases output drops when shocks occur. On the other hand, according to the neo-classical view a flexible labor market increases the speed of output adjustment. Therefore, the second research question is: what is the relationship between labor market flexibility and the impact of the current financial crisis on output and unemployment?

Thirdly, the main theme of this dissertation is the effect of financial crises on central bank independence. As already mentioned, the current financial crisis threatens the independence of central banks. Besides the engagement of monetary policy in fiscal operations, the dismissal of central bank governors in the current financial crisis in some countries has also indicated that central banks risk political exposure. We examine whether financial crises affect the probability that a central bank governor will be replaced. The study that comes closest studies to ours is Dreher et al. (2010) who, among other things, examine whether currency devaluations affect the likelihood of a central bank governor replacement. In our study, we use both regular and irregular replacements of central bank governors as indicator of central bank independence. Financial crises are decomposed into currency crises, banking crises, and debt crises. Following Vuletin and Zhu (2011), we also consider the nature of a central bank governor's replacement, i.e. whether the new central bank governor comes from the executive branch of the

government (government ally) or not (non-government ally). Hence, the main questions addressed in this part are: what is the effect of financial crises on the replacement of a central bank governor?; and is a new central bank governor more likely to come from the ranks of the executive branch of the government (government ally) or not (non-government ally)?

Finally, we examine an issue that has led several observers to worry about during the current financial crisis: "do fiscal deficits and debt crises cause inflation?" Many studies have examined the effect of fiscal deficits on inflation. A study by Catão and Terrones (2005) finds that fiscal deficits lead to higher inflation, notably so in high-inflation countries. However, less attention has been given to the effect of debt crises on inflation. Reinhart and Rogoff (2008) document that since World War II, inflation and debt default have gone hand-in-hand. In addition, theoretically Davig et al. (2011) and Davig and Leeper (2011) explain that if the economy faces a 'fiscal limit' an unsustainable debt path will lead to inflation. Hence, the last chapter of this dissertation explores the effect of fiscal deficits and debt crises on inflation in developing countries taking dynamics and parameter heterogeneity into account.

To summarize, the research questions that will be addressed in this dissertation are: **first**, how have the legal and actual independence of Bank Indonesia (BI) developed since its creation to the present time; **second**, what role does labor market flexibility play when it comes to the impact of the most recent financial crisis on output and unemployment?; **third**, what is the effect of financial crises on the replacement of a central bank governor?; **fourth**, do fiscal deficits and debt crises cause inflation in developing countries? The next section will explain the methods employed and the main findings of this dissertation.

1.2 Methodology and Main Findings

1.2.1 Legal and Actual Independence of Bank Indonesia (BI)

In order to measure the independence of Bank Indonesia, we extend both the legal CBI index constructed by Cukierman (1992) and the actual CBI index introduced by Cukierman (2007). The index of Cukierman (1992) covers 4 main aspects of CBI: independence of the chief executive officer (CEO), independence in policy formulation, preference for low inflation, and absence of forced lending to the government. We add financial independence to the Cukierman legal index.

Financial independence is defined as the ability of the central bank to attain its objective(s) efficiently without financial assistance from the government (Stella, 2005). The three components of financial independence included are: determination of the central bank's budget, decision-making on the allocation of central bank profits, and the responsibility of the central bank to bear losses. In practice, financial independence is represented by a strong income position that provides necessary means to obtain its objective(s) (Jacome and Vazquez, 2008). When the level of central bank capital is negative or below some critical threshold, politicians may influence the central bank as it depends on additional government capital, thereby limiting the independence of the bank (Cukierman, 2008). Financial independence is important, notably during financial crises when the central bank often has to support ailing financial institutions, but it is generally neglected by studies measuring CBI. Most studies assume that central banks have an unlimited ability to meet their obligations by creating money. In fact, central banks cannot both obtain their target and be forced to create money at the same time (Stella, 2005).

For actual independence, we consider institutional and economic aspects that possibly affect each item of the legal CBI index of Cukierman (1992). Furthermore, we also examine the implementation of the central bank laws in practice. The economic and institutional aspects that are considered include financial market development, the size of government deficits, the type of exchange rate regime, and the function of the central

bank as a development bank. The detailed components of actual independence are presented in Chapter 2.

We find that before 1999, the legal and actual independence of Bank Indonesia diverged substantially. The actual independence of Bank Indonesia is much higher than its legal independence during that period. After Bank Indonesia was mandated as a legally independent institution by a new central bank law, its legal independence increased and converged to actual independence. Furthermore, we find that the actual independence of Bank Indonesia is negatively and significantly related to inflation.

1.2.2 Labor Market Flexibility and the Impact of the Financial Crisis

In Chapter 3, we apply factor analysis on the indicators of labor market flexibility provided by Gwartney et al. (2009). Labor market flexibility is measured by using six indicators: minimum wage, mandated cost of hiring, mandated cost of worker dismissal, hiring and firing regulations, centralized collective bargaining, and conscription. Based on the factor analysis, we identify 3 factors: labor market regulation, dismissal cost, and hiring cost.

The impact of the global financial crisis on output is measured as the percentage decrease of real GDP from peak to through during the first quarter of 2007 until the first quarter of 2010. Meanwhile, the impact of the crisis on unemployment is measured by the change of the unemployment rate from peak to through during the first quarter of 2007 until the first quarter of 2010.

By employing cross-country regressions and including control variables like trade and capital market integration, fiscal balance, financial vulnerability, and institutional differences, we find that lower hiring cost reduce the output loss, notably so in high-income countries. However, the duration of the crisis is longer in case of low dismissal cost, notably so in low-income countries. Meanwhile, in industrial countries lower hiring

cost is related to a lower employment loss due to the financial crisis, but the size of the effect is rather small.

1.2.3 Financial Crises and the Dismissal of Central Bank Governors

A conditional fixed effects logit model is employed in Chapter 4 to examine the effect of financial crises on the probability that a central bank governor will be replaced. Information on central bank governor turnovers and their legal term in office is taken from the KOF Swiss Economic Institute (Dreher et al., 2010). We consider both regular and irregular turnovers of central bank governors. Moreover, financial crises data come from Laeven and Valencia (2008). Financial crises are divided into 3 categories: banking, currency and debt crises.

We follow Dreher et al. (2010) and Klomp and De Haan (2010), but extend their work in different directions. First, we examine the effect of financial crises on the likelihood that a central bank governor will be replaced. Second, we examine whether central bank independence and an inflation-targeting monetary policy strategy mediate the effect of financial crises on the probability of a central bank governor turnover. Third, we employ conditional logit models with clustered standard errors given the inertial nature of the variables involved. Finally, following Vuletin and Zhu (2011), we also investigate whether the new governor who is appointed after the occurrence of a financial crisis is an ally of the government or not.

Using a sample covering 101 countries during the period 1970-2007, we find that financial crises significantly increase the likelihood of a central bank governor turnover. When we decompose crises into banking, currency, and debt crises we find that banking crises and debt crises significantly increase the likelihood that a central bank governor will be replaced. Our results also suggest that financial crises increase the probability that a non-government ally will be appointed as new central bank governor.

1.2.4 The Effect of Fiscal Deficits and Debt Crises on Inflation in Developing Countries

The relationship between fiscal deficits, debt crises and inflation is dynamic. Moreover, it is likely that there is parameter heterogeneity across countries. Neglecting parameter heterogeneity may lead to inconsistent estimates and potentially misleading inference even for panels with large N and T (see Pesaran and Smith, 1995; Pesaran et al., 1999). Hence, to cover the dynamic and parameter heterogeneity aspects, two approaches can be applied, which are: the mean group (MG) estimation and the pool mean group (PMG) estimation.

The mean group (MG) assumes that the intercepts, slope coefficients, and error variance differ across countries. Moreover, the MG assumes that the short-run and the long-run effect of fiscal deficits and debt crises on inflation are heterogenous across countries. On the other hand, the PMG estimation allows the intercept, short-run coefficients, and error variances to differ across countries, while the long-run coefficients are constrained to be the same across individual countries.

The results of Chapter 5 show that fiscal deficits and debt crises have a significant positive effect on inflation in the long run. These effects are homogenous across countries. The results are robust when we include either fiscal balance as share of GDP or as share of M1 as an explanatory variable. We also find that the long-run effects of fiscal deficits and debt crises on inflation are conditional on the level of inflation and (for debt crises) on political instability. The higher the rate of inflation, the larger will be the effect of fiscal deficits and debt crises on inflation. Likewise, the effect of a debt crisis on inflation becomes stronger when political instability increases.

Chapter 2

Legal and Actual Central Bank Independence: A Case Study of Bank Indonesia

2.1 Introduction

During the last two decades, many countries changed their central bank laws to grant their monetary authorities greater independence. Also the central bank of Indonesia (Bank Indonesia, BI) became more independent in 1999. It is widely believed that without sufficient independence, central banks will give in to pressure from politicians who may be motivated by short-run electoral considerations or may value short-run economic expansions highly while discounting the longer-run inflationary consequences of expansionary policies (Walsh, 2005).[1] If the ability of politicians to distort monetary policy results in excessive inflation, countries with an independent central bank should experience lower rates of inflation. There is indeed strong evidence for a negative

[1] One theory underlying this view is the time inconsistency approach to monetary policy-making. The basic message of this theory is that government suffers from an inflationary bias and that, as a result, inflation is sub-optimal. Rogoff (1985) has shown that when monetary policy is delegated to an independent and 'conservative' central banker this inflationary bias will be reduced. Conservative means that the central banker is more averse to inflation than the government, in the sense that he places a greater weight on price stability than the government does.

relationship between central bank independence (CBI) and inflation, as shown in the meta-analysis of Klomp and De Haan (2010).

This paper assesses the independence of Bank Indonesia since its creation in 1953 until 2009 by constructing and comparing two measures of independence: a legal independence indicator and an actual independence indicator. The legal indicator follows Cukierman (1992) and is based on the central bank law in place. Following Cukierman (2007), the actual independence indicator takes several economic and institutional aspects into account that could affect the independence of the central bank, such as financial market development, the size of government deficits, the exchange rate regime, and the function of the central bank as a development bank.

Our main finding is that actual independence of Bank Indonesia diverged from legal independence before the bank became legally independent in 1999. During this period, actual independence of Bank Indonesia was higher than its legal independence. After the central bank law was changed in 1999, legal independence increased significantly and converged to actual independence. Our findings also suggest that actual independence of BI is negatively related to inflation, confirming the results of several previous studies (Eijffinger and De Haan, 1996; Klomp and De Haan, 2010).

The chapter is organized as follows. Section 2.2 explains the methodology applied to construct indicators of legal and actual CBI. Section 2.3 constructs the legal index of Cukierman (1992) for Bank Indonesia and compares it with legal indexes of other studies. This section also compares the legal independence of Bank Indonesia and central banks in other developing countries. Section 2.4 presents the extended index for legal independence of Bank Indonesia, while section 2.5 constructs the index of actual independence for Bank Indonesia. Section 2.6 compares the indicators of legal and actual CBI for Bank Indonesia. Section 2.7 provides the estimation results of the relationship between inflation and the indicators of actual and legal CBI. The final section offers the conclusions.

2.2 Methodology

2.2.1 General Approach

Most empirical studies on central bank independence (CBI) use either an indicator based on central bank laws in place, or an indicator based on the so-called turnover rate of central bank governors. The most widely employed legal CBI index is from Cukierman (1992) and Cukierman et al. (1992)[2], although alternative measures have been developed (see Arnone et al. 2006 for an extensive comparison of the various CBI indicators). A serious drawback of CBI indicators based on the central bank laws in place is that the interpretation of these laws is subjective because many central bank laws are incomplete and leave room for different interpretations (Berger et al., 2001). In addition, legal independence measures tend to be static and cannot capture institutional and economic factors that affect the actual independence of the central bank. Legal measures of CBI may therefore not reflect the true relationship between the central bank and the government. Especially in countries where the rule of law is less strongly embedded in the political culture, there can be wide gaps between the formal, legal institutional arrangements and their practical impact (Walsh, 2005).

Cukierman (1992) and Cukierman et al. (1992) argue that the actual average term in office of the central bank governor may therefore be a better proxy for CBI than measures based on central bank laws. The turnover rate of central bank governors (TOR) is based on the presumption that, at least above some threshold, a higher turnover of central bank governors indicates a lower level of independence. However, a low TOR does not necessarily imply that the central bank is independent. It could reflect the presence of a subservient governor who tends to stay in office longer. Furthermore, also the TOR may not fully capture the institutional and economic changes, which affect central bank independence in practice. Cukierman (2007) therefore constructed an index of actual CBI by considering various economic and institutional aspects, such as financial market development, the size of government deficits, the type of exchange rate regime, and the function of the central bank as a development bank.

[2] The only difference between the indicators of Cukierman (1992) and Cukierman et al. (1992) is the procedure employed to aggregate the various dimensions of CBI into one measure.

We extend both the legal CBI index constructed by Cukierman (1992) and the actual CBI index introduced by Cukierman (2007) in order to assess the independence of Bank Indonesia. In constructing the legal index we will add financial independence to the Cukierman legal index. Financial independence is defined as the ability of the central bank to attain its objective(s) efficiently without financial assistance from the government (Stella, 2005). In practice, financial independence is represented by a strong income position that provides the central bank with necessary means to obtain its objective(s) (Jacome and Vazquez, 2008). When the level of central bank capital is negative or below some threshold, politicians may influence the central bank as it depends on additional government capital, thereby limiting the independence of the bank (Cukierman, 2008). The central bank's financial position is generally neglected in studies on the institutional aspects of central banking since central banks are assumed to have an unlimited ability to meet their obligations by creating money. However, this assumption is not realistic as central banks cannot both obtain their target and be forced to create money at the same time (Stella, 2005). Therefore, financial independence should be taken into account when measuring central bank independence.

Apart from adding financial independence, our legal index for Bank Indonesia follows Cukierman (1992). However, our legal index for BI differs from that of Cukierman due to differences in the interpretation of the various central bank laws in place. To minimize subjectivity and to check our interpretation of the laws in place, we interviewed staff of Bank Indonesia.[3] Moreover, we compared our index with those of other studies that employ Cukierman's (1992) methodology, like Polillo and Guillén (2005).

As legal CBI indexes tend to be static and cannot capture the institutional and economic factors that affect the actual independence of a central bank, we construct an index of actual independence for Bank Indonesia following a similar approach as Cukierman (2007).

[3] The interviews were held in March 2009 in Bank Indonesia, Jakarta, Indonesia. We discussed the score of each component of our legal index with Bank Indonesia's legal department.

2.2.2 The Extended Cukierman Index of Legal CBI

The index of Cukierman (1992) includes 16 components - each coded on a scale of 0 (lowest level of independence) to 1 (highest level of independence) - covering 4 main aspects of CBI: independence of the chief executive officer (CEO), independence in policy formulation, preference for low inflation, and absence of forced lending to the government. As outlined before, we add financial independence to the Cukierman legal index. We consider three components of financial independence: determination of the central bank's budget, decision-making on the allocation of central bank profits, and the responsibility of the central bank to bear its losses.

A central bank that has authority to determine its budget and profit allocation is considered to be financially independent and assigned the highest score (1). On the other hand, if government or parliament intervene, for instance because they have to approve the budget and profit allocation, the central bank is not financially independent and is assigned the lowest score (0). With respect to losses, the highest score is given to central banks that are responsible for their own losses without any assistance from the government. The lowest score is assigned to central banks requiring government's assistance to recapitalize. When the level of central bank capital is negative or below some threshold, the government has to recapitalize the central bank, limiting its independence (Cukierman, 2008).

Since we add three components of financial independence to the Cukierman (1992) index, the total number of components is 19. This implies that the weight of financial independence is 0.16 (3 items covering financial independence divided by 19). The weights of the other four main aspects of legal CBI are: independence of the CEO: 0.21; independence in policy formulation: 0.16; preference for low inflation: 0.05; and absence of forced lending to the government: 0.42. The overall index is computed by firstly aggregating the 19 components into five subgroups; the weighted means of these five subgroups gives the legal CBI index. Table A.1 in the Appendix provides a detailed comparison of our legal index and the Cukierman (1992) index.

2.2.3 A New Index Measuring Actual Independence

We extend Cukierman's (2007) approach to come up with an index of actual CBI by considering institutional and economic aspects that possibly affect each item of the legal CBI index of Cukierman (1992). Furthermore, we examine the implementation of central bank law in practice. Figure 2.1 shows the information used to construct the actual index. The index also consists of 19 components covering the same five dimensions of CBI as the legal index discussed in the previous section.

The first dimension, independence of the CEO, is affected by the tenure of the CEO, the background of the CEO, the frequency of and grounds for dismissal, and other positions of the CEO. The item on the tenure of the CEO examines whether central bank governor turnover overlaps with executive change. It is closely related to the political vulnerability of central banks introduced by Cukierman and Webb (1995). When the central bank governor is replaced within 1 month after the change of the executive, the central bank is not independent from political intervention. Regarding the background of CEO, we consider five possibilities: independent expert (highest score), central bank staff, central bank/government staff, government staff, and politician (lowest score). If the CEO keeps his position until the end of his legal term in office, the central bank is considered independent from political pressure. If the central bank governor is replaced frequently without clear reasons, the central bank is not independent. In between, we consider other reasons for dismissal (running from a high to a low score): resignation; poor performance; crime and corruption; reasons related to policy; and political participation. If the CEO of the central bank holds other positions, this may affect the independence of the central bank. For instance, if the CEO also has a position in government he will not be independent from political interests.

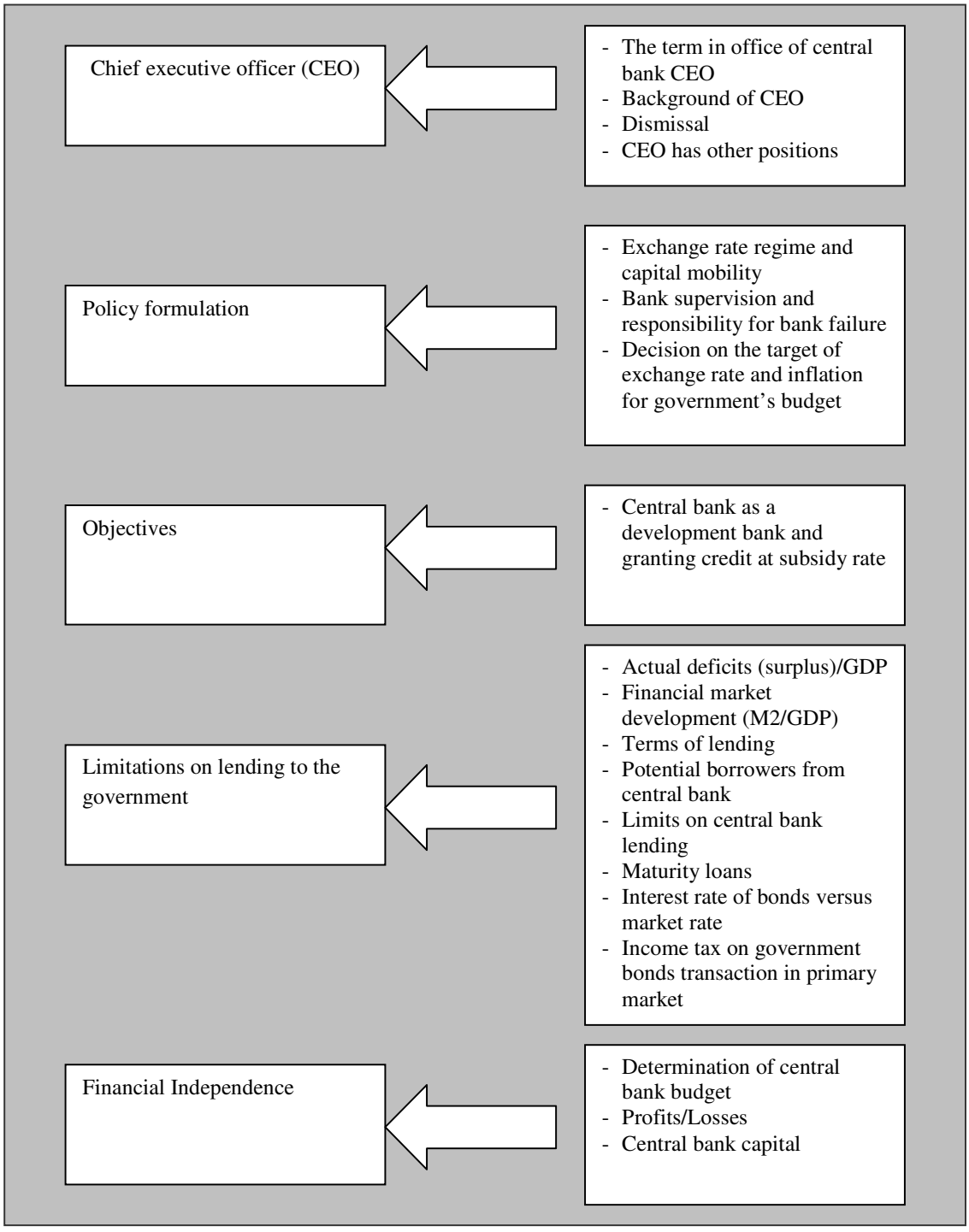
The second aspect of CBI is policy formulation. In practice, independence in formulating monetary policy is affected by institutional arrangements, such as the exchange rate regime in place and capital mobility, whether the bank is responsible for banking supervision, and its role as lender of last resort. Under a fixed exchange rate regime and perfect capital mobility, the central bank tries to maintain the exchange rate

constant. In such a situation the central bank will be shielded from political pressure, as any deviation from the objective to keep the exchange rate fixed will be highly visible. In contrast, under a flexible exchange rate and perfect capital mobility, the exchange rate is fully determined by the markets and this may give politicians an incentive to intervene in monetary policymaking.[4]

Moreover, independence in formulating monetary policy is affected if the central bank is responsible for banking supervision and has a role as lender of last resort (Cukierman, 2007). If the central bank is responsible for banking supervision, it faces a trade-off in the short run between attaining financial market stability and price stability (Noia and Giorgio, 1999; Goodhart and Schoenmaker, 1995). For instance, a surprise increase in interest rates will squeeze private banks' profits and may lead to defaults (Cukierman, 1992). As lender of last resort, the central bank may need to inject liquidity at the risk of sacrificing price stability. Therefore, a central bank with responsibility for banking supervision and with a role as lender of last resort is not independent in formulating monetary policy. The final variable that may affect CBI is the role of the central bank in deciding on the assumptions underlying the government budget plans. If the central bank has no role to play, it is arguably not independent in formulating its monetary targets.

[4] Empirical results for the relationship between exchange rate regimes and independence of monetary policy are mixed. Whereas Frankel et al. (2004) find that pegged exchange rate regimes increase the autonomy of central banks Shambaugh (2004) reports that countries with a fixed exchange rate have less independent monetary policy.

Figure 2.1 Legal and Actual Aspects of Central Bank Independence



The third dimension of CBI is the objective of monetary policy. In practice, CBI can be affected if the central bank functions as a development bank, as it will be more concerned with stimulating economic growth and employment than with maintaining price stability. Therefore, in constructing our actual CBI index, we assign the lowest score to a central bank that is heavily involved in granting subsidized credits to the private sector.

The next aspect of CBI refers to limitations on lending to the government. In practice, the likelihood that a central bank will provide credit to the government will depend on the magnitude of fiscal deficits and the degree of financial development (Cukierman, 2007). The higher fiscal deficits are, the greater will be the likelihood that the central bank provides loans to the government. If financial markets are not well developed, the economy's capacity to absorb government securities is limited. As pointed out by Sargent and Wallace (1981), the government may force the central bank to finance deficits if this maximum has been reached. Therefore, central bank lending to the government will be high if financial markets are less developed. We use the ratio of M2/GDP as an indicator of financial market development. The numerical scores for financial development are based on the quartile distribution of M2/GDP for all countries.[5] The final variable that we take up under this heading is taxes levied on government bonds transactions in the primary market. If the government levies taxes it will decrease the incentive of the central bank to buy government securities in the primary market. This issue arose in Indonesia when the Ministry of Finance levied income taxes on government bond transactions.[6]

Finally, we turn to financial independence. As suggested by Stella (2005), in order to be financially independent, a central bank requires a strong financial position. If a central bank does not have a strong financial position, it will be restricted to conduct monetary policies that will create losses but are needed to attain monetary objectives, such as open market operations and sterilization of foreign currency inflows (Dalton and

[5] Data come from the World Bank's World Development Indicators (WDI) data set.
[6] This policy was in place from 2006 until 2008. In 2008, a new tax law was enacted that implied that Bank Indonesia should not pay this tax anymore.

Dziobek, 2005). To measure financial independence, we consider the actual responsibility for decisions regarding the central bank budget and the distribution of central bank profits. The final variable related to financial independence in practice is the difference between actual and required capital. If the central bank's capital is higher than required, the central bank is financially independent to conduct monetary policy. On the other hand, if the central bank's capital is lower than required and it needs assistance from the government to improve its capital, the central bank is not financially independent. The index of actual CBI is computed in the same way as the extended legal index. Table A.2 in the Appendix provides the detailed components of the actual index in comparison with the legal index.

2.3 Legal Independence of Bank Indonesia

2.3.1 Cukierman (1992) Index

Four central bank laws have been in place between 1953, when Bank Indonesia was created, to the present time. The Act 11/1953 was created to nationalize the Javanese Bank, the former central bank before Indonesia became independent. The Act 11/1953 has been revised twice in order to relax the maximum amount of credit that Bank Indonesia could provide to the government. The relaxation of maximum credit was motivated to finance its high budget deficits in the 1950s caused by military operations in some regions that wanted to be independent from Indonesia. Due to those revisions the legal CBI index of Bank Indonesia decreased. High fiscal deficits, hyperinflation, and low income per capita in 1960s were the reasons that a new law (Act 13/1968) was introduced under President Soeharto. This law has been in place for around 30 years. After the fall of Soeharto and the occurrence of a deep economic crisis, Bank Indonesia became an independent institution by the new Act 23/1999. The law was revised in 2004 by parliament to improve coordination between monetary policy and fiscal and real sector policies. Table 2.1 shows the scores for the Cukierman (1992) index for legal independence of Bank Indonesia for the various laws in place. Table A.3 in the Appendix

provides further details for the scores for each component of the index under the various laws in place.

The legal independence of Bank Indonesia under Act 11/1953 (0.39) was higher than under Act 13/1968 (0.22). The new act reduced the independence of Bank Indonesia especially due to the relaxation of the provisions concerning credit to the government. Under Act 13/1968, there is no limit to provide credit to the government. Moreover, based on Act 13/1968, Bank Indonesia became a development bank.

Under Act 23/1999, the legal independence of Bank Indonesia increased significantly from 0.22 to 0.75. All components of the legal CBI index increased, except for the item on the interest rate on loans to the government on which the law did not provide details. Based on the new law, Bank Indonesia was strictly prohibited to provide credit to the government and the private sector. In addition, Bank Indonesia became more independent as the central bank governor is appointed by parliament and not by the government, while maintaining price stability became the only objective of Bank Indonesia (Alamsyah et al., 2001). However, as parliament considered Bank Indonesia as too independent, Act 23/1999 was replaced by Act 3/2004. Consequently, the legal independence of Bank Indonesia decreased to 0.63. Under Act 3/2004, Bank Indonesia is allowed to buy short-term government bonds in the primary market for monetary control operations. Moreover, Bank Indonesia may buy government securities on the primary market as part of the provision of the emergency financing facility. This implies that Bank Indonesia can provide credit to the government.

Table 2.1 Cukierman's Index of Legal Independence for Bank Indonesia, 1953-2009

Description of variable	The Act 11/1953	The Act 11/1955	The Act 84/1958	The Act 13/1968	The Act 23/1999	The Act 3/2004
Chief executive officer (CEO)	**0.31**	**0.31**	**0.31**	**0.36**	**0.71**	**0.71**
Term in office	0.50	0.50	0.50	0.50	0.50	0.50
Who appoints CEO	0.25	0.25	0.25	0.25	0.50	0.50
Dismissal	0.00	0.00	0.00	0.17	0.83	0.83
May CEO hold other offices in government?	0.50	0.50	0.50	0.50	1.00	1.00
Policy formulation	**0.27**	**0.27**	**0.27**	**0.27**	**0.75**	**0.75**
Who formulates monetary policy?	0.67	0.67	0.67	0.67	1.00	1.00
Who has final word in resolution of conflict?	0.20	0.20	0.20	0.20	1.00	1.00
Role in the government's budgetary process	0.00	0.00	0.00	0.00	0.00	0.00
Objectives	**0.40**	**0.40**	**0.40**	**0.40**	**0.60**	**0.60**
Limitation on lending to the government	**0.46**	**0.50**	**0.46**	**0.09**	**0.81**	**0.57**
Advances (limitation on non-securitized lending)	0.67	0.67	0.67	0.00	1.00	1.00
Securitized lending	0.00	0.00	0.00	0.00	1.00	0.67
Terms of lending (maturity, interest, amount)	0.67	0.67	0.67	0.33	1.00	0.33
Potential borrowers from the bank	1.00	1.00	1.00	0.00	0.00	0.00
Limits on central bank lending defined in	0.33	1.00	0.33	0.00	1.00	0.00
Maturity of loans	0.00	0.00	0.00	0.00	0.00	0.67
Interest rates on loans must be	0.25	0.25	0.25	0.50	0.25	0.75
Prohibition from buying/selling government securities in the primary market	0.00	0.00	0.00	0.00	1.00	0.00
Average Index	**0.39**	**0.41**	**0.39**	**0.22**	**0.75**	**0.63**

Source: Act 11/ 1953; Act 11/1955; Act 84/1958; Act 13/1968; Act 23/1999; Act 3/2004

2.3.2 Our Index Compared with Other Similar Legal CBI Indicators

This section compares our legal index of Bank Indonesia based on Cukierman (1992) with similar indicators as suggested by Cukierman et al. (1992), Polillo and Guillén (2005), and Ahsan et al. (2008). Polillo and Guillén (2005) employed Cukierman's (1992) method in constructing their legal index of CBI for several countries. Ahsan et al. (2008) used a different method, but some components of their index are comparable to the components of the Cukierman (1992) index. We use the time periods as suggested by Cukierman (1992), i.e., 1950-59; 1960-71; 1972-79; and 1980-89. In addition, we use the periods 1990-98, 1999-2003, and 2004-now. Table 2.2 shows a detailed comparison of our version of Cukierman's legal index of Bank Indonesia with those of the other studies.

It becomes clear that our legal index differs from the Cukierman et al. (1992) index. During the period of 1950-59, our legal index is higher. Some components, such as the final word in resolution of conflict; objectives; advance; and term of lending are assigned a higher score than in Cukierman et al. (1992). For instance, Act 11/1953 explicitly stated that in case there is disagreement between the government and the governor of Bank Indonesia on policy decisions, the government has the final word subject to possible protest by central bank governor. It implies that the governor of Bank Indonesia still has the right to propose his opinion in formulating monetary policy. Hence, we assigned a score of 0.2 for this sub-component rather than zero as in Cukierman et al. (1992). Moreover, for the component "objective", Cukierman et al. (1992) assigned a score of 0, which means that price stability is not considered as an objective for monetary policy. However, we assigned a score 0.4 for this component, as under Act 11/1953 Bank Indonesia is responsible for price stability and credit development.

In addition, there is a strange coding in the Cukierman index for the period 1960-1971 during which there were two laws in place: the Act 84/1958 (revision of the Act 11/1953) for the period 1960-1967 and the Act 13/1968 for the period 1968-1971. According to Cukierman's method, whenever a change of law occurred twice within a decade, the classification was done in line with the legislation that was in effect during at least half of that decade. It means that during the period 1960-1971, the coding is based

on Act 84/1958. As mentioned above, Act 84/1958 is just a revision of Act 11/1955; the only change being the limit of lending. However, the Cukierman score for the component "objective" in period 1960-1971 increased from 0 in 1950-1959 to 0.4. This does not make much sense since there was no revision regarding this component in Act 84/1958.

The legal independence of Bank Indonesia significantly increased when the new Act 23/1999 was enacted. Our legal index during period 1999-2003 is 0.75. The index constructed by Polillo and Guillén (2005) is even higher (0.8). Unfortunately, we cannot make a detailed comparison for all components because Polillo and Guillén (2005) do not provide detailed information. In 2004, Act 23/1999 was replaced by Act 3/2004, which decreased independence due to a lower score for the component "limitation on lending". Our scoring for the most recent law can be compared with some components that Ahsan et al. (2008) also included. For dismissal, these authors assigned a score 0.5 while we gave a score of 0.83. Under Act 3/2004, the Governor of Bank Indonesia shall not be discharged during his term in office, unless he resigns or if there is evidence, which proves that he has committed a crime, or is permanently prevented from serving his office. In our opinion, these provisions are not related to policy, hence, the score for dismissal is 0.83. Our score for the component "objective" is also different from the Ahsan et al. score. For this component, we assign a score of 0.6 since the Act states that the objective of the central bank is not only price stability but also financial stability.

Table 2.2 Our Cukierman-Based Legal Index Compared with Other Legal CBI Indicators for Bank Indonesia

Description of variable	Our Index 1950-1959	Cukierman's Index 1950-1959	Our Index 1960-1971	Cukierman's Index 1960-1971	Our Index 1972-1979	Cukierman's Index 1972-1979	Our Index 1980-1998	Cukierman's Index 1980-1998	Our Index 1999-2003	Polillo& Guillén Index 1999-2003	Our Index 2004-2009	Ahsan Index 2004-2009
Chief executive officer (CEO)												
Term of office	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	-	0.50	0.50
Who appoints CEO	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.50	-	0.50	0.50
Dismissal	0.00	0.00	0.00	0.00	0.17	0.00	0.17	0.00	0.83	-	0.83	0.50
May CEO hold other offices in government?	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	-	1.00	1.00
Policy formulation												
Who formulates monetary policy?	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	1.00	-	1.00	1.00
Who has final word in resolution of conflict?	0.20	0.00	0.20	0.00	0.20	0.20	0.20	0.20	1.00	-	1.00	1.00
Role in the government's budgetary process	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	
Objectives	0.40	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.60	-	0.60	0.80
Limitation on lending to the government												
Advances (limitation on non-securitized lending)	0.67	0.33	0.67	0.33	0.00	0.00	0.00	0.00	1.00	-	1.00	-
Securitized lending	0.00	0.33	0.00	0.33	0.00	0.00	0.00	0.00	1.00	-	0.67	-
Terms of lending (maturity, interest, amount)	0.67	0.00	0.67	0.00	0.33	0.33	0.33	0.33	1.00	-	0.33	-
Potential borrowers from the bank	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	-	0.00	-
Limits on central bank lending defined in	0.33	0.33	0.33	0.33	0.00	0.33	0.00	0.33	1.00	-	0.00	-
Maturity of loans	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33	0.00	-	0.67	-
Interest rates on loans must be	0.25	0.25	0.25	0.25	0.50	0.25	0.50	0.25	0.25	-	0.75	-
Central bank prohibited from buying or selling government securities in the primary market?	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	-	0.00	-
Average Index	**0.39**	**0.24**	**0.39**	**0.30**	**0.22**	**0.27**	**0.22**	**0.27**	**0.75**	**0.80**	**0.63**	-

Sources: Cukierman et al. (1992); Polillo and Guillén (2005); Ahsan et al. (2008)

2.3.3 Bank Indonesia Compared to Central Banks in Other Developing Countries

Table 2.3 shows the legal independence of various central banks in developing countries. In the first three decades, most central banks received a low score on the Cukierman index of legal independence (below 0.5). During 1972-1989, Bank Indonesia is less independent compared to most central banks in other developing countries, although the index of central banks in some countries (like Brazil, Morocco, Nepal, Pakistan, and Panama) is even lower. In the 1990s, various countries (like Argentina, Chile, Mexico, Peru and Venezuela) amended their central bank laws thereby increasing legal independence. After the new Act 23/1999 was introduced, the legal CBI index of Bank Indonesia increased significantly to 0.75, the second highest score. Only the central bank of Chile surpassed BI.

There is a group of countries with a constant level of central bank independence over the full of period. Those countries are Morocco, Nepal, Brazil, Pakistan, Thailand, China, Malaysia, and Nigeria. Several other countries experienced multiple index changes, such as Panama, Uruguay, India, Mexico, Ethiopia, Venezuela, Chile, Egypt, and Indonesia. In the second group of countries, CBI increased over time, reflecting the conventional wisdom that monetary policy will benefit from greater independence.

Table 2.3 Legal Independence of BI Compared to Other Central Banks

Countries	Cukierman's Index				Polillo&Guillén Index	
	1950-1959	1960-1971	1972-1979	1980-1989	1990-1998	1999-2000
Argentina	-	-	0.40	0.40	0.74	0.74
Bolivia	0.30	0.30	0.30	0.30	0.30	0.63
Botswana	-	-	0.33	0.33	0.33	0.45
Brazil	-	0.21	0.21	0.21	0.21	0.21
Chilie	0.26	0.26	0.46	0.46	0.77	0.77
China	0.29	0.29	0.29	0.29	0.29	0.29
Colombia	-	0.27	0.27	0.27	0.44	0.44
Costa Rica	-	0.47	0.47	0.47	0.47	0.61
Egypt	0.52	0.52	0.49	0.49	0.55	0.55
Ethiopia	-	-	0.40	0.40	0.44	0.44
Honduras	0.43	0.43	0.43	0.43	0.43	0.55
India	0.25	0.34	0.34	0.34	0.34	0.34
Indonesia*	0.39	0.39	0.22	0.22	0.22	0.75
Kenya	-	0.44	0.44	0.44	0.44	0.50
Malaysia	-	0.36	0.36	0.36	0.36	0.36
Mexico	0.25	0.34	0.34	0.34	0.56	0.56
Morocco	-	0.14	0.14	0.14	0.14	0.14
Nepal	0.18	0.18	0.18	0.18	0.18	0.18
Nigeria	-	0.37	0.37	0.37	0.37	0.37
Pakistan	0.21	0.21	0.21	0.21	0.21	0.21
Panama	0.24	0.24	0.22	0.22	0.22	0.22
Peru	-	0.43	0.43	0.43	0.74	0.74
Phillipines	0.43	0.43	0.43	0.43	0.48	0.48
S.Africa	0.25	0.25	0.25	0.25	0.25	0.48
Thailand	0.27	0.27	0.27	0.27	-	-
Uruguay	0.22	0.22	0.24	0.24	0.24	0.54
Venezuela	0.28	0.28	0.43	0.43	0.63	0.63

The legal index for Indonesia is based on our index in Table 2.2.
Sources: Cukierman et al. (1992); Polillo and Guillén (2005)

2.4 The Extended Index of Legal CBI for Bank Indonesia

We extend Cukierman's (1992) legal index by including financial independence proxied by responsibilities for (decisions on) the central bank's budget, the allocation of the central bank's profit, and the central bank's losses. Table 2.4 presents the extended legal index. Table A.1 in the Appendix provides details for each component of the index. In this section we motivate our scores for financial independence.

Under Act 11/1953 and Act 13/1968, the central bank budget is proposed by the board of governors of Bank Indonesia and should be approved by the government. It implies that decisions on the central bank budget are taken by the central bank and the executive. Hence, we assign a score of 0.5 for the first component of financial independence. The score increased to the highest score 1, since Act 23/1999 stipulates that the central bank's budget is formulated by the central bank's governor without approval from the executive or legislative. After the Act 23/1999 was revised, the score for this component decreased since the new Act requires the legislative's approval of the operational budget. As a result, we assigned a score of 0.5.

The second component of financial independence refers to the allocation of the central bank's profits. Under Act 11/1953, it is up to BI to decide on the allocation of its profits and we therefore assigned the highest score. Under Act 13/1968, the allocation of the central bank's profit is decided upon by the central bank and the government. Consequently, the score for this component decreased to 0.5. However, according to Act 23/1999 and Act 3/2004, profits of BI should be transferred to the central bank's reserves until the solvency requirement is fulfilled. The rest of the profits should be transferred to the government. Thus, we assigned the highest score for this component.

Table 2.4 The Extended Legal Independence Index for Bank Indonesia

Description of variable	Act No 11/1953	Act No 11/1955	Act No 84/1958	Act No 13/1968	Act No 23/1999	Act No 3/2004
Chief executive officer (CEO)	**0.31**	**0.31**	**0.31**	**0.36**	**0.71**	**0.71**
Term of office	0.50	0.50	0.50	0.50	0.50	0.50
Who appoints CEO	0.25	0.25	0.25	0.25	0.50	0.50
Dismissal	0.00	0.00	0.00	0.17	0.83	0.83
May CEO hold other offices in government?	0.50	0.50	0.50	0.50	1.00	1.00
Policy formulation	**0.27**	**0.27**	**0.27**	**0.27**	**0.75**	**0.75**
Who formulates monetary policy?	0.67	0.67	0.67	0.67	1.00	1.00
Who has final word in resolution of conflict?	0.20	0.20	0.20	0.20	1.00	1.00
Role in the government's budgetary process	0.00	0.00	0.00	0.00	0.00	0.00
Objectives	**0.40**	**0.40**	**0.40**	**0.40**	**0.60**	**0.60**
Limitation on lending to the government	**0.46**	**0.50**	**0.46**	**0.09**	**0.81**	**0.57**
Advances (limitation on non-securitized lending)	0.67	0.67	0.67	0.00	1.00	1.00
Securitized lending	0.00	0.00	0.00	0.00	0.00	0.67
Terms of lending (maturity, interest, amount)	0.67	0.67	0.67	0.33	1.00	0.33
Potential borrowers from the bank	1.00	0.67	1.00	0.00	0.00	0.00
Limits on central bank lending defined in	0.33	0.33	0.33	0.00	1.00	0.00
Maturity of loans	0.00	0.00	0.00	0.00	0.00	0.67
Interest rates on loans must be	0.25	0.25	0.25	0.50	0.25	0.75
Central bank prohibited from buying or selling	0.00	0.00	0.00	0.00	1.00	0.00
government securities in the primary market?						
Financial Autonomy	**0.83**	**0.83**	**0.83**	**0.67**	**0.83**	**0.67**
Determination of the central bank's budget	0.50	0.50	0.50	0.50	1.00	0.50
Determination of the allocation of bank profits	1.00	1.00	1.00	0.50	1.00	1.00
Who is responsible for central bank losses	1.00	1.00	1.00	1.00	0.50	0.50
Average Index	**0.46**	**0.47**	**0.46**	**0.28**	**0.77**	**0.65**

Sources: The Act 11/ 1953; the Act 11/1955; the Act 84/1958; the Act 13/1968; the Act 23/1999; the Act 3/2004.

The final component of financial independence is responsibility for the central bank's losses. Under Act 11/1953 and Act 13/1968, BI was responsible for its losses by using its own reserves without any assistance from the government, so that we assigned the highest score. In contrast, Act 23/1999 and Act 3/2004 foresee that if the central bank's capital is lower than required, the government should recapitalize the bank by issuing bonds. If capital is higher than required, the central bank is responsible for its losses by using its reserves. Hence, we assigned a score of 0.5 for this component.

Including financial independence into the Cukierman's (1992) legal index components affects the overall legal independence index of Bank Indonesia. Table 2.4 shows that the extended legal index of Bank Indonesia is higher than the legal index outlined in the previous section. This is caused by the weight and scores assigned to financial independence components.

2.5 The Actual Independence of Bank Indonesia

Table 2.5 presents our indicator of the actual independence of Bank Indonesia. It becomes clear that actual independence of BI varies over time. The lowest level of actual independence occurred during the period 1959-1965 when three components of the index of actual independence (objective and limitation on lending) received a low score compared to other periods.

Between 1959 and 1965, there were three governors in office: Soetikno Slamet (1959-1960), Soemarno (1960-1963), and Jusuf Muda Dalam (1963-1966). The turnover of most central bank governors overlapped (within 0-1 month) with a change of the cabinet. The dismissal of Soemarno in 1963 was without a clear reason, while the dismissal of Jusuf Muda Dalam in 1966 was caused by his membership of the communist party. Therefore, the score for the component "background of the governor" is very low in this period. Furthermore, Bank Indonesia played an important role as a development bank providing (subsidized) credits to the private sector. Finally, large fiscal deficits

(exceeding 6 % of GDP) and a low level of financial development (M2/GDP was less than 7%) further reduced the actual independence of Bank Indonesia.

In contrast, the average score for the policy formulation components was relatively high in the period 1959-1965. The change from a flexible to a fixed exchange rate system and the delegation of banking supervision from Bank Indonesia to a new ministry increased the actual independence in policy formulation (Rahardjo, 1995).[7] In 1963, the government relaxed the regulation requiring exporters to report all of their foreign exchange revenues to Bank Indonesia, thereby reducing the control on capital flows.

The index of actual independence of Bank Indonesia increased during consecutive periods until 2003. During the period 1966-1982, known as the period of stabilization and rehabilitation, the components "background of the CEO" and "dismissal" contributed significantly to the increase of actual independence. The governor during the period 1973-1983, Rachmat Saleh, was from Bank Indonesia. Moreover, all governors were in office until the end of their legal term in office, while balanced government budgets and the fast financial development increased the independence of Bank Indonesia in practice.

[7] A multiple exchange rate system was adopted in 1957 and the Governor of Bank Indonesia became member of the cabinet. In addition, banking supervision responsibility was delegated to a new ministry, the so-called the Ministry of Banking and Private Sectors Regulation (see also Bank Indonesia, 2005 and Bank Indonesia, 2006).

Table 2.5 Actual Independence Index of Bank Indonesia, 1953-2009

Description of variable	Average Actual Index of Bank Indonesia					
	1953-1958	1959-1965	1966-1982	1983-1998	1999-2003	2004-2008
Chief executive officer (CEO)	**0.77**	**0.56**	**0.68**	**0.62**	**0.91**	**0.78**
Tenure of CEO	0.92	0.50	0.35	0.00	1.00	1.00
Background of CEO	0.29	0.18	0.40	0.52	0.65	0.25
Dismissal	0.86	0.69	0.95	0.96	1.00	0.89
CEO holds other offices	1.00	0.86	1.00	1.00	1.00	1.00
Policy formulation	**0.42**	**0.45**	**0.50**	**0.47**	**0.50**	**0.25**
Exchange rate regime and capital mobility	0.67	0.67	1.00	0.88	0.00	0.00
Banking supervision and funding for bank failure	0.50	0.57	0.50	0.50	0.50	0.50
Decision on inflation and exchange rate target	0.00	0.00	0.00	0.00	1.00	0.00
Objective: Function as a development bank& credit subsidy	**0.00**	**0.00**	**0.00**	**0.52**	**1.00**	**1.00**
Limitation on lending to the government	**0.44**	**0.33**	**0.52**	**0.64**	**0.60**	**0.56**
Actual deficits(surplus)/GDP	0.61	0.28	1.00	0.96	0.74	0.67
Financial market development	0.00	0.00	0.19	0.61	0.80	0.75
Terms of lending (maturity, interest, amount)	0.67	0.67	0.37	0.33	0.00	0.00
Potential borrowers from the bank	0.50	0.50	0.06	0.03	0.50	0.50
Limits on central bank lending defined in	0.50	0.50	0.06	0.03	0.50	0.50
Maturity of loans	0.33	0.33	0.65	0.67	0.67	0.67
Interest rates on loans	0.50	0.50	0.50	0.50	0.75	0.75
Tax on Primary market transaction	0.00	0.00	0.00	1.00	1.00	0.67
Financial Independence	**0.83**	**0.83**	**0.83**	**0.83**	**1.00**	**0.72**
Determination of central bank's budgets	0.50	0.50	0.50	0.50	1.00	0.50
Profits/Losses	1.00	1.00	1.00	1.00	1.00	0.67
Actual capital of central bank	1.00	1.00	1.00	1.00	1.00	1.00
Average Index	**0.58**	**0.49**	**0.62**	**0.68**	**0.78**	**0.65**

Sources: Bank Indonesia (2005); Bank Indonesia (2006); Bank Indonesia (1953-2008); International Financial Statistics (IFS); World Development Indicators (WDI); Rahardjo (1995)

During 1983-1998, when the government liberalized policies, various components of the index of actual independence (notably objectives and limitation on lending to government) increased significantly. The cap on interest rate was abolished. The real interest rate was positive in this period. Moreover, in 1990 Bank Indonesia restricted its credits to the private sector, while fiscal balance was maintained and financial markets developed further, triggered by the deregulation policies conducted by the government in the 1980s. The deregulation in the banking sector aimed to attract both domestic and foreign investors and to mobilize domestic savings for financing economic development. During the economic crisis in 1997, 16 small insolvent banks were closed. Bank Indonesia provided emergency liquidity support to banks to prevent contagion. However, this led to the dismissal of governor Soedradjad Djiwandono, two months before completing his term, thereby reducing the actual independence of Bank Indonesia from political intervention.

The actual independence of Bank Indonesia reached the highest level during 1999-2003, when the central bank was legally mandated as an independent institution. All the components of the index of actual independence increased during this period. The CEO component increased significantly as the turnover of central bank governors did not overlap with the change of the executive. Moreover, the governor during this period (Sjahril Sabirin) was from Bank Indonesia. Although there was some pressure from President Abdurrahman Wahid on Sjahril Sabirin to resign, the governor stayed until the end of his legal term in office arguing that under the new Act 23/1999, the governor of Bank Indonesia cannot be dismissed. In addition, even though Bank Indonesia remained responsible for banking supervision, the costs of the banking crisis burdened the government's budget. For instance, in the banking crisis in 1998 liquidity support was provided by the government rather than Bank Indonesia. Moreover, in 2004 the Deposit Insurance Agency (DIA) was established to guarantee private savings in the banking sector (Siregar and James, 2006). Due to those institutional changes, Bank Indonesia faced less of a tradeoff between maintaining price stability and maintaining financial stability. Bank Indonesia could determine its budget solely without any interventions from government or parliament.

However, actual independence of Bank Indonesia decreased during 2004-2008 because of several factors. During this period, both governors (Burhanuddin Abdullah and Boediono) had a background as a former Economics minister. In addition, the dismissal of Governor Burhanuddin Abdullah due to corruption reduced the actual independence of BI. Related to policy formulation, government decided on the inflation and exchange rate assumptions underlying the government budget plans. Moreover, the elimination of the tax on the primary government bond market transactions of BI increased the attractiveness for the central bank to buy government bonds in the primary market. Finally, since 2004 BI could no longer determine its budget solely as approval by the legislative was required.

2.6 Legal Versus Actual Independence of Bank Indonesia

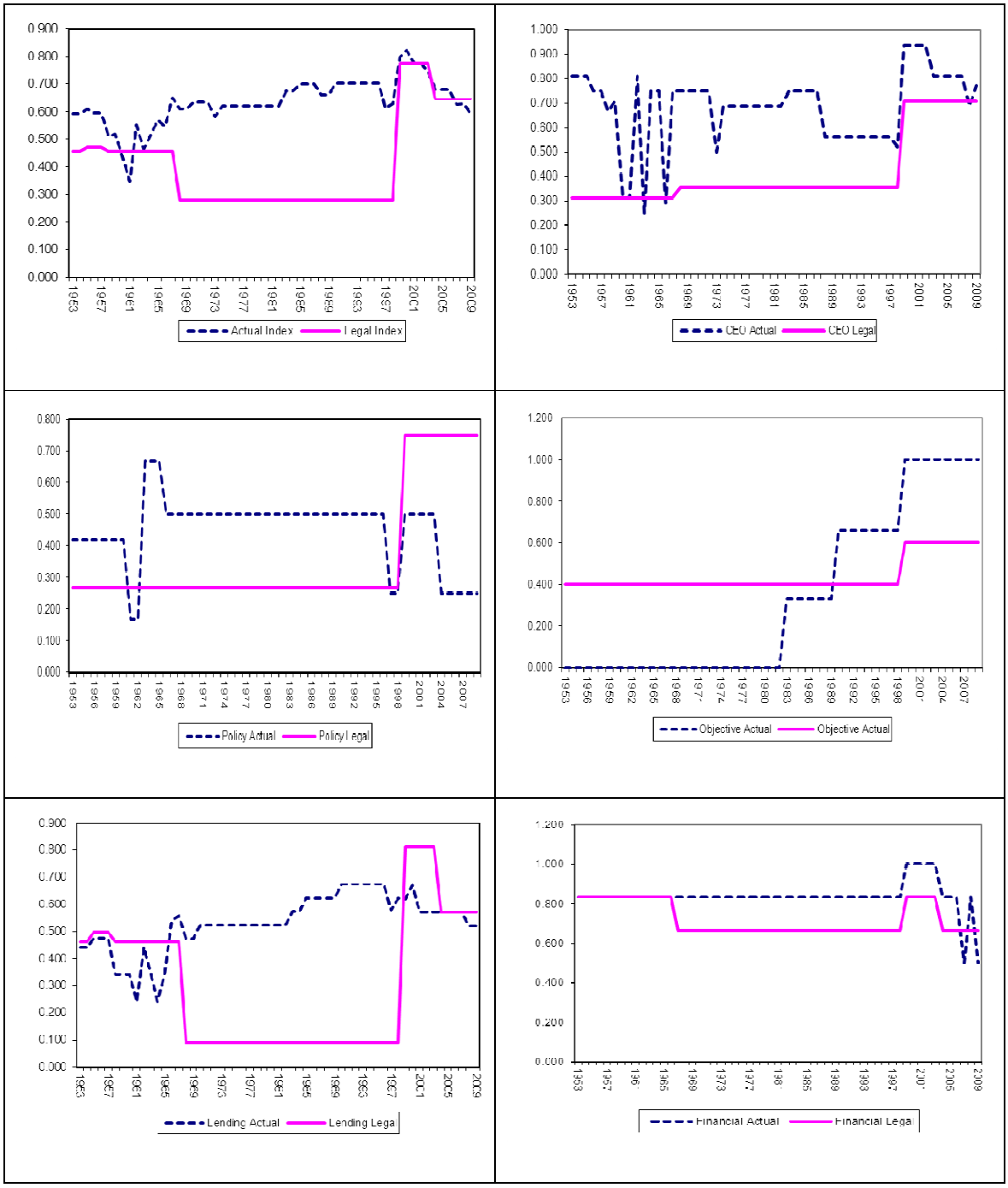
Figure 2.2 shows that actual and legal independence of Bank Indonesia diverged notably during the period 1968-1998. Under Act 13/1968, the legal independence dropped while actual independence increased. In fact, the index of actual independence was significantly higher than the legal index in this period. Several factors, like the improvement of the government's fiscal position and the development of financial markets, decreased the pressure on Bank Indonesia to provide credit to the government, be it directly or indirectly. Also other factors, like the background of governors (mostly coming from Bank Indonesia) and the absence of dismissals, contributed to the divergence of the actual index from the legal index. Interestingly, these developments occurred under the authoritarian Soeharto regime. After 1999, when the central bank was mandated as an independent institution, the legal index increased significantly and converged to the actual index.

Looking at each group of components, the actual index of CEO is significantly lower than the legal index of CEO in 1963 and 1966, because the governor of Bank Indonesia at that time, Jusuf Muda Dalam, belongs to a political party and he was

dismissed because of his political affiliation. Moreover, the actual index of CEO background was volatile during the period 1953-1967, because the central bank governor turnover rate was very high. Due to the introduction of a flexible exchange rate regime during the economic crisis in 1998, the actual independence of Bank Indonesia dropped significantly. Because Bank Indonesia played a significant role as a development bank and granted credit at subsidized rates during 1953-1982, the actual index of objectives was at the lowest level. However, after the maximum interest rate policy was eliminated in 1983 and Bank Indonesia was prohibited to provide credit to the private sector in 1999, the actual index of objectives became higher than the legal index. In addition, the legal index of lending limits tended to converge to the actual index after Bank Indonesia was mandated as independent institution. The actual index of financial independence decreased significantly in 2007 and 2009, because Bank Indonesia experienced losses.[8]

[8] Based on the annual reports of Bank Indonesia, 1953-2009.

Figure 2.2 Legal Versus Actual Independence of Bank Indonesia



Source: Authors' calculation

2.7 Inflation and Independence of Bank Indonesia

In order to analyze whether the independence of Bank Indonesia is related to inflation, we estimate a time series model for transformed inflation using the indicators of legal and actual independence as regressors.[9] We use the data from 1958 to 2009. Table 2.6 shows the estimation results. In column (1) we include the lagged values of our indicators of legal and actual independence. The results show that the index of actual independence has a negative and significant effect on inflation.

In the next step, we include the components of the actual independence index (CEO, policy formulation, objectives, limitation on lending, and financial) into the model. The results in column (2) show that only the coefficient of limitations on lending is significantly negative. In column (3) we include the difference between the actual and the legal index. The estimation results suggest that the difference between actual and legal index has a negative and significant effect on inflation. When we consider the difference between each component of the actual and legal CBI, it turns out that the difference between actual and legal limitations on lending is statistically significant with a negative sign (column 4).

[9] The transformed inflation is calculated as follow: $D = \pi/(1+\pi)$, where π is the rate of inflation. We use the transformed inflation to reduce the influence of extreme observations.

Table 2.6 Inflation and Central Bank Independence, 1958-2009

Explanatory Variables	Dependent Variable: Transformed Inflation			
	(1)	(2)	(3)	(4)
Intercept	1.032**	0.916**	0.288**	0.324**
	(0.163)	(0.300)	(0.045)	(0.051)
Legal Index (-1)	0.256			
	(0.134)			
Actual Index (-1)	-1.488**			
	(0.260)			
CEO Actual Index (-1)		-0.144		
		(0.152)		
Policy Formulation Actual Index (-1)		0.165		
		(0.227)		
Objectives Actual Index (-1)		0.020		
		(0.081)		
Lending Actual Index (-1)		-1.221**		
		(0.257)		
Financial Actual Index (-1)		-0.068		
		(0.354)		
Differences between Actual and Legal Index (-1)			-0.431**	
			(0.154)	
Diff. CEO Index (-1)				0.096
				(0.169)
Diff. Policy Formulation Index (-1)				0.353
				(0.135)
Diff. Objectives Index (-1)				-0.046
				(0.090)
Diff. Lending Index (-1)				-0.351**
				(0.102)
Diff. Financial Index (-1)				-0.845
				(0.338)
R-Squared	0.410	0.470	0.140	0.570
Number of Observations	51	51	51	51

** indicates significance at 1% level. The number in parentheses is the standard error.

2.8 Conclusions

Indicators of central bank independence based on the interpretation of the central bank law in place may not capture actual independence. Moreover, legal independence measures tend to be static and cannot capture institutional and economic factors that affect the actual independence of the central bank. Therefore, this paper not only develops legal indicators of the independence for Bank Indonesia (BI) for the period 1953-2009 by extending the legal CBI constructed by Cukierman (1992), but also introduces an index for the actual independence of BI, extending the approach suggested by Cukierman (2007).

In constructing the legal index we add financial independence of central bank to the index of Cukierman (1992). Financial independence is defined as the ability of the central bank to attain its objective(s) efficiently without financial assistance from the government. To measure actual independence, we consider institutional and economic factors that affect the independence of Bank Indonesia, such as the exchange rate regime and capital mobility; central bank as development bank; fiscal deficits; and the degree of financial market development. We also consider other factors that may affect actual independence, like the background of the governors and the reasons for their dismissal.

We find that before 1999 (during the Soeharto era), legal and actual independence of BI diverged substantially. The actual independence of Bank Indonesia is much higher than its legal independence during that period. A good background of the governors, no dismissals, the improvement of fiscal deficits, financial development, and the deregulation of economy are amongst the factors contributing to a high level of actual independence of Bank Indonesia. After Bank Indonesia was mandated as a legally independent institution by a new central bank law, legal independence of BI increased and converged to actual independence. All aspects of legal CBI increased significantly, especially the independence in monetary policy formulation and the absence of forced lending to the government.

Our results suggest that there is a significant and negative relationship between the index of actual independence and inflation. When we include the components of the

index of actual independence, only limitations on lending to government comes out significantly.

Chapter 3

Labor Market Flexibility and the Impact of the Financial Crisis[10]

3.1 Introduction

The recent financial crisis, which originated in the US, has also hit the rest of the world. However, the impact of the crisis on economic activity varies widely across countries, reflecting differences in exposure and vulnerability to financial crises, heterogeneity in macroeconomic structures, and differences in policy responses (Berkmen et al., 2009). A few recent studies have examined the impact of the global financial crisis on output identifying factors that may explain cross-country differences in the impact of the financial crisis. For instance, Berkmen et al. (2009) find that countries with more leveraged domestic financial systems and more rapid growth in lending to the private sector tended to suffer more from the crisis, while countries exporting advanced manufacturing goods were more affected than those exporting food. Also countries with

[10] This Chapter is based upon Artha and De Haan (2011).

pegged exchange-rate regimes fared significantly worse than countries with a more flexible exchange rate regime.[11]

Up to now, there is no study examining the relationship between labor market flexibility and the impact of the financial crisis on output.[12] This chapter examines for 56 countries over the period of 2007 until the first quarter of 2010 whether cross-country differences in the impact of the financial crisis on the loss of output and the duration of the crisis are related to differences in labor market flexibility. We measure the output loss by the decrease of real GDP from peak to through. Likewise, the duration of the crisis is the length of the period between the peak and the through of real GDP. Employing a cross-country model that includes control variables such as trade and capital market integration, financial development, monetary and fiscal policy, institutional differences, and population growth, we find that lower hiring cost reduce the output loss, notably so in high-income countries. However, the duration of the crisis is longer in case of low dismissal cost, notably so in low-income countries. The latter finding is in line with the results of Bentolila and Bertola (1990) and Bertola (1990) who argue that a reduction of firing cost does not increase firms' marginal propensity to hire, but strongly affects their willingness to fire. This study also explores the impact of labor market flexibility on differences in the employment loss across countries due to the global financial crisis.

3.2 Defining Labor Market Flexibility and Output Loss

According to Solow (1997), a labor market is inflexible if the level of benefits is too high, if there are too many restrictions on the freedom of employers to fire and to hire, if the hours of work are too tightly regulated, if excessively generous compensation for overtime work is mandated, if trade unions have too much power to protect incumbent workers against competition, or if statutory health and safety regulations are too stringent.

[11] Other relevant studies are Berglöf et al. (2009), Naudé (2009) and Rose and Spiegel (2009).
[12] The paper that comes closest to ours is Forteza and Rama (2006), who report that countries with relatively rigid labor markets experienced deeper recessions and slower recoveries.

In our empirical work, we will apply factor analysis on the indicators of labor market flexibility provided by Gwartney et al. (2009).[13] These data come close to the concept of labor market flexibility as outlined by Solow (1997). Gwartney et al. (2009) measure labor market flexibility using six indicators: minimum wage (*MW*), mandated cost of hiring (*MHC*), mandated cost of worker dismissal (*MDC*), hiring and firing regulations (*HFR*), centralized collective bargaining (*CCB*), and conscription (*CNS*). The indicators range between 0 and 10, where a higher score indicates a more flexible labor market.[14]

Table 3.1 presents summary statistics for the labor market indicators and other variables used in the analysis (to be discussed below). Table 3.1 shows that the average scores of all labor market indicators are much lower than the maximum score. High-income countries have higher scores for the minimum wage and dismissal cost indicators than the other countries. It implies that the minimum wage and dismissal cost of high-income countries are lower than those of other countries. Meanwhile, the costs of hiring in high-income countries exceed those in the other countries in our sample.

[13] These data have been widely used as a proxy for market flexibility. See, for instance, Pitlik (2002; 2008) and Weede and Kämpf (2002).

[14] The minimun wage is based on the World Bank's Doing Business data for the ratio of mandated minimum wage to the average value added per worker. The formula used to calculate the zero-to-10 rating was: $(V_{max}-V_i)/(V_{max}-V_{min})$ multiplied by 10, where V_i represents the actual data for country *i*, V_{max} is the maximum value, and V_{min} is the minimum value in the sample. Mandated cost of hiring is based on the World Bank's Doing Business data on the cost of all social security and payroll taxes and the cost of other mandated benefits including those for retirement, sickness, health care, maternity leave, family allowance, and paid vacations and holidays associated with hiring an employee. The same formula is applied as for minimum wages to calculate the rating. Mandated cost of dismissal is based on the World Bank's Doing Business data on the cost of the advance notice requirements, severance payments, and penalties due when dismissing a redundant worker. Again the same formula is used to come up with the ratings. Hiring and firing regulations is based on the Global Competitiveness Report's (from the World Economic Forum) question: "The hiring and firing of workers is impeded by regulations (= 1) or flexibly determined by employers (= 7)." Centralized collective bargaining is based on the Global Competitiveness Report's question: "Wages in your country are set by a centralized bargaining process (= 1) or up to each individual company (= 7)." Data on the use and duration of military conscription were used to construct rating intervals for conscription. A rating of 10 was assigned to countries without military conscription. When conscription periods exceeded 18 months, countries were rated zero. Full details are available at: http://www.freetheworld.com/2009/reports/world/EFW2009_app.pdf.

Table 3.1 Summary Statistics for Labor Market Indicators and Other Variables Used

Variables	All Countries			High-income Countries			Others		
	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
Crisis Variables									
Output Loss	0.13	0.08	0.52	0.11	0.08	0.40	0.17	0.02	0.52
Duration	4.27	1.00	10.00	4.97	1.00	9.00	3.33	1.00	10.00
Labor Market Indicators (10-point scale)									
Minimum Wage	6.86	0.50	10.00	7.31	4.80	10.00	6.26	0.50	10.00
Hiring and Firing Regulations	4.59	1.80	8.30	4.42	1.80	8.30	4.82	2.20	7.30
Centralized Collective Bargaining	6.44	2.60	8.70	6.22	2.60	8.70	6.73	3.60	8.30
Mandated Cost of Hiring	4.16	0.00	10.00	3.74	0.00	9.70	4.72	0.60	10.00
Mandated Cost of Worker Dismissal	6.53	0.00	10.00	7.49	1.20	10.00	5.25	0.00	9.60
Conscription	6.75	0.00	10.00	6.22	2.60	8.70	6.50	0.00	10.00
Trade									
Trade Barriers (10-point scale)	7.25	2.40	9.20	7.91	6.60	9.20	6.38	2.40	7.80
Openness	0.99	0.26	4.29	1.08	0.26	4.29	0.89	0.38	2.00
Financial Integration									
Capital Market Restrictions (10-point scale)	6.00	3.30	8.60	6.41	4.30	8.60	5.47	3.30	8.40
Financial Development									
Credit to GDP	0.90	0.10	3.10	1.15	0.22	3.10	0.58	0.10	1.74
Log GDP per Capita	4.23	3.30	4.60	4.48	4.20	4.60	3.90	3.30	4.25
Financial Vulnerability									
Credit Growth	0.06	-0.89	0.89	0.09	-0.89	0.89	0.02	-0.25	0.82
Policy Framework									
Stability of Inflation (10-point scale)	9.17	6.80	9.90	9.48	8.50	9.90	8.75	6.80	9.70
Change of Fiscal Deficits (% GDP)	0.03	-0.13	0.11	0.04	-0.04	0.09	0.02	-0.13	0.11
Exchange rate regime (1 = flexible)	0.57	0.00	1.00	0.47	0.00	1.00	0.71	0.00	1.00
Institutions									
Governance	-0.02	-1.90	1.44	0.66	-0.45	1.44	-0.92	-1.90	0.51
Population Growth	0.01	-0.01	0.03	0.01	-0.01	0.03	0.01	-0.01	0.02
Number of Countries	56	56	56	32	32	32	24	24	24

Source: International Financial Statistics (IFS), Gwartney et al. (2009), World Development Indicators (WDI), Kaufmann et al. (2009).

Table 3.2 shows the correlation among the various indicators of labor market flexibility. Hiring and firing regulations (*HFR*) are significantly associated with centralized collective bargaining (*CCB*) and conscription (*CNS*), although with a different sign. In addition, minimum wages (*MW*) are closely related to the mandated cost of worker dismissal (*MDC*), while the correlation of the mandated cost of hiring (*MHC*) and the other labor market indicators is low.

Table 3.2 Correlation Matrix of Indicators of Labor Market Flexibility

	MW	*HFR*	*CCB*	*MHC*	*MDC*	*CNS*
MW	1.0000					
HFR	0.1683	1.0000				
CCB	-0.0291	0.5190*	1.0000			
MHC	-0.1042	0.2557	0.1545	1.0000		
MDC	0.3165*	0.2244	0.0823	-0.1633	1.0000	
CNS	0.0041	-0.2880*	0.0154	0.0904	0.1343	1.0000

Notes: * indicates that the variable is significant at 5% confidence level

In order to evaluate to which extent the labor market indicators capture the same information, we apply factor analysis (*FA*) to the indicators of labor market flexibility in 2007 for 56 countries (see the list of countries in Table B.1 in the Appendix).

Specifically, the *FA* analysis can be represented as follows:

$$x = B\xi + \varepsilon \tag{3.1}$$

where x denotes a vector of observed variables (i.e., the indicators); B is the matrix of factor loadings; ξ represents a vector of the latent variable labor market flexibility; and ε is a random error term, which is assumed to be uncorrelated with the latent variables. The covariance matrix of the model is:

$$\sum = B\Phi B' + \Theta \tag{3.2}$$

Where $\sum$ is the covariance matrix of x, Φ is the covariance matrix of ξ, and Θ is the covariance matrix of ε. This equation is estimated using the maximum likelihood (ML) function

$$L = \log|\Sigma| + tr(\Sigma^{-1}S) \tag{3.3}$$

where S is the sample covariance matrix. To obtain the appropriate number of factors we use Catell's scree test, which selects the number of factors based on eigenvalues higher than 1. As three factors have eigenvalues higher than 1, we use three factors.

Having optimized the likelihood function, the factor loadings matrix is rotated by the Oblimin rotation method, so that it will be easier to interpret the findings. The Oblimin rotation method allows for correlation among the factors and minimizes the correlation of the columns of the factor loadings matrix. Table 3.3 shows the estimation results of the rotated factor solution.

Table 3.3 Rotated Factor Loading Matrix

	Factor		
	1	**2**	**3**
Hiring and Firing Regulation (*HFR*)	.925	.228	.212
Centralized Collective Bargaining (*CCB*)	.492	.070	.096
Conscription (*CNS*)	-.387	.137	.156
Mandated Cost of Worker Dismissal (*MDC*)	-.112	1.005	.000
Minimum Wages (*MW*)	.083	.318	-.067
Mandated Cost of Hiring (*MHC*)	.096	-.165	.984

Note: Rotation Method: Oblimin with Kaiser Normalization

Since the Oblimin rotation method minimizes the correlation between columns of the factor loadings matrix, each indicator has a high loading on one factor, while it has a low loading on the other factors. Table 3.3 shows that the first factor has high loadings on hiring and firing regulations, centralized collective bargaining, and conscription. Those indicators are related to how the labor market is regulated; hence we label this factor "*labor market regulation*". Meanwhile, the indicators of mandated cost of worker dismissal and minimum wage have high factor loadings for factor 2; this factor is therefore labeled as "*dismissal cost*". The indicator of cost of hiring loads high on factor 3, which is therefore labeled as "*hiring cost*".[15] Some studies argue that those labor market flexibility indicators have an impact on unemployment (see Bentolila and Bertola, 1990; Bertola, 1990; and Feldmann, 2003).

[15] The final scores of each factor are calculated using a regression-based approach, which is a linear combination of all of the labor market flexibility indicators, weighted by the corresponding factor loading matrix. The final scores of each factor will be used for the estimations in the next section.

The impact of the global financial crisis on output is measured as the percentage decrease of real GDP from peak to through during the first quarter of 2007 until the first quarter of 2010 (see Table B.1 in the Appendix for details). Our sample period is determined by data availability and the fact that the crisis in the US subprime mortgage sector started in August 2007 (see also Berglöf et al., 2009). The peak is defined as the point in time with the highest level of real GDP, while the through is the point in time with the lowest real GDP. Furthermore, we consider the duration of the crisis as the period from peak to through (see Table B.1 in the Appendix for details). As not all countries were out of the recession at the end of this period, the impact of the crisis on output loss and the duration of the crisis are underestimated.[16]

3.3 Estimation Method

To examine the effect of labor market flexibility on the decline in output following the financial crisis, we estimate the following cross-section model:

$$Y_i = \alpha + \beta L_i + \gamma Z_i + \varepsilon_i \tag{3.4}$$

In our first model, Y is the percentage change of real GDP from peak to through, L is our index of labor market flexibility, and Z is a vector of control variables such as trade linkages, financial integration, financial development, monetary and fiscal policy, institutional factors, and population growth. In our second model, Y represents the duration of the crisis.

The trade linkages are represented by two variables: regulatory trade barriers and openness. The regulatory trade barriers consist of non-tariff barriers and compliance cost of importing and exporting. The data come from Gwartney et al. (2009) and range from 0 to 10, where a higher score indicates fewer trade barriers. Openness is measured by the ratio of exports and imports to GDP, taken from the World Bank´s World Development

[16] Some countries, such as Bulgaria, Denmark, Estonia, Finland, Greece, Iceland, Latvia, Lithuania, Romania, and Slovenia, still had a negative growth at the end of the sample period.

Indicators (WDI). It is expected that countries depending on trade will be more affected by the global financial crisis. Moreover, we consider the composition of trade (food, industrial, and fuel commodities) data on which is provided by the United Nations. Berkmen et al. (2009) report that countries exporting manufacturing products have been hit harder by the crisis than those exporting food.

Financial integration is proxied by international capital market controls. This indicator includes restrictions on foreign ownership of companies and the degree of capital controls. The data is provided by Gwartney et al. (2009). Similar to regulatory trade barriers, this variable ranges between 0 and 10. A higher score implies more integration. As the global financial crisis originated in the financial sector in developed countries, we hypothesize that countries with fewer financial restrictions will be hit harder by the global financial crisis.

Financial development is represented by the ratio of domestic credit to GDP. We expect that financially more advanced countries will be hit harder by the crisis (Rose and Spiegel, 2009). The data come from the World Development Indicators. In addition, we consider GDP per capita as indicator of economic development level.

Taylor (2009) argues that excessive credit growth contributed to the global financial crisis. We therefore include the cumulative growth of domestic credit during 2003-2005 as explanatory variable. We expect that countries that experienced high credit growth prior to the crisis suffer stronger output losses. The data come from the World Development Indicators.

We also include proxies for the heterogeneity of monetary and fiscal policy frameworks across countries before the crisis. The monetary policy framework is represented by the volatility of inflation and a dummy for the exchange rate regime, while the fiscal policy framework is proxied by the change of the government budget balance to GDP. The latter variable also captures that various governments followed expansionary fiscal policies to reduce the impact of the financial crisis. We expect that countries with more stable inflation and with flexible exchange rates can handle external shocks more easily (Berkmen et al., 2009). The data for inflation stability come from

Gwartney et al. (2009) and run from 0 to 10. A higher value of this variable indicates more stable inflation. We use the IMF´s the facto exchange rate classification. The exchange rate regime is represented by a dummy variable that is one in case of a flexible exchange rate regime.[17] Countries with more expansionary fiscal policies are expected to suffer less from the crisis. The fiscal stimulus is measured by the change of the fiscal balance per GDP from 2008 to 2009, which is provided by WDI.[18]

The final aspect that may affect the severity of the crisis is the quality of governance that can be defined as the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them. Kaufmann et al. (2009) provide data on six dimensions of governance: voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption. We apply factor analysis to these indicators of governance to come up with an appropriate measure for the quality of governance. Catell's scree test suggests one factor for governance. All six indicators of governance have high loadings on this factor, which will therefore be used in the estimations. We expect that countries with good governance will be better able to manage the impact of the financial crisis. In addition, we also control for population growth.

All labor market indicators and control variables used in the estimations refer to years before the crisis, except for the fiscal variable. Table B.2 in the Appendix lists all explanatory variables and provides their sources. Table 3.1 shows that high-income countries are more open to international trade and have fewer financial restrictions. In

[17] We divide the exchange rate regimes into two types: fixed and flexible exchange rate regimes. A fixed exchange rate regime consists of exchange rate arrangements with separate legal tender; currency board arrangements, conventional fixed peg arrangements; pegged exchange rate within horizontal bands; crawling pegs; and exchange rate within crawling bands. Flexible exchange rate regimes include managed floating and independently floating.

[18] There may be a reverse-causality problem using this indicator, but data on the cyclically adjusted budget balance were not available for all countries in our sample.

addition, financial markets of high-income countries are more developed, while these countries also had higher credit growth before the crisis. With respect to the policy framework, high-income countries have more stable inflation and more expansionary fiscal policies than the other counties in our sample. Likewise, the quality of governance of high-income countries is much better than that of the other countries.

Table 3.4 shows the correlation matrix of the labor market indicators and the control variables. It turns out that our labor market flexibility indicators have a low correlation with most control variables. However, our governance indicator is highly correlated with some other control variables such as regulatory trade barriers, credit to GDP, and GDP per capita.

3.4 Estimation Results

Table 3.5 shows the estimation results for the impact of the financial crisis on output loss. In column (1), we include our labor market flexibility indicators and all control variables. We find that the indicators of labor market flexibility do not have a significant effect on output loss. However, after highly insignificant variables are excluded from the model, the coefficient of hiring cost becomes statistically significant with a negative sign (see column 2). The results do not change when we include the composition of export into the estimations (see columns 3, 4, and 5). The negative sign implies that lower hiring cost (i.e. more flexibility) leads to a smaller output loss. According to the magnitude of the coefficient, a one-point increase in the hiring cost score (lower hiring cost) reduces output loss by about 0.021 points. So if a country moved from the lowest (Spain) to the highest score of our indicator of hiring cost (New Zealand), its output loss would decline by 0.076 points

.

Table 3.4 Correlation Matrix

	LMR	*DC*	*HC*	*RTB*	*OP*	*FI*	*CR*	*GCAP*	*CRG*	*INF*	*EXC*	*FB*	*GOV*	*POP*
LMR	1													
DC	0.11	1												
HC	0.01	0.00	1											
RTB	-0.14	0.15	0.03	1										
OP	0.13	0.18	-0.04	0.22	1									
FI	0.01	0.28*	0.22	0.44*	0.22	1								
CR	-0.12	0.15	0.39*	0.35*	-0.14	0.05	1							
GCAP	-0.23	0.34*	-0.02	0.71*	0.13	0.38*	0.51*	1						
CRG	0.05	0.22	-0.14	0.23	0.06	0.16	0.15	0.15	1					
INF	-0.31*	0.17	-0.02	0.37*	-0.06	0.13	0.43*	0.47*	0.01	1				
EXC	0.27*	0.07	0.33*	-0.19	-0.23	-0.15	0.04	-0.19	-0.32*	-0.27*	1			
FB	-0.18	0.11	-0.01	0.14	-0.05	0.18	0.14	0.40*	-0.24	0.08	-0.14	1		
GOV	-0.16	0.38*	0.21	0.74*	0.18	0.41*	0.59*	0.86*	0.18	0.47*	-0.14	0.19	1	
POP	0.14	-0.32*	0.35*	-0.14	0.16	-0.17	0.12	-0.11	-0.27*	-0.04	-0.29*	-0.29*	0.04	1

Notes: *LMR* is labor market regulations*; DC* is dismissal cost; *HC* is hiring cost; *RTB* is regulation on trade barriers; *OP* is openness; *FI* is financial integration; *CR* is credit to GDP; *GCAP* is log GDP per capita; *CRG* is credit growth; *INF* is inflation stability; *EXC* is exchange rate regime; *FB* is change of fiscal balance to GDP; *GOV* is governance indicator; *POP* is population growth.*indicates that the correlation is significant at the 5% confidence level.

As to the control variables, our results suggest that regulatory trade barriers are statistically significant with a negative sign. It implies that fewer restrictions on international trade will lead to a lower output loss. The magnitude of the coefficient is stable for all model specifications. A coefficient of -0.061 means that a one-point increase in trade barriers score (i.e. fewer trade restrictions) reduce output loss by 0.061 points. However, countries depending on trade are more vulnerable to external shocks. As the global financial crisis caused a sharp decline in international trade, countries in which the contribution of trade to GDP is high suffered more from the crisis. Our indicators of trade composition are not significant. This finding is in contrast with the results of Berkmen et al. (2009) who report that the share of food in total exports is associated with smaller output growth revisions, which they use as indicator of the output loss due to the financial crisis.

As expected, capital market integration has a positive and statistically significant effect on output loss due to the financial crisis (see columns 2-5). The global financial crisis originated in the financial sector in high-income countries and subsequently hit countries having highly integrated financial markets with advanced economies. Moreover, countries that experienced rapid credit growth prior to the global crisis were hit hard. This result is in line with the findings of Berkmen et al. (2009) that high domestic credit growth caused a larger decline in output during the global financial crisis.

Stability of inflation has a negative and significant effect on output loss. It implies that the countries in which the monetary authorities could keep inflation stable were less affected by the financial crisis. Meanwhile, the coefficients of the other policy framework indicators, i.e. the exchange rate regime dummy and the change of fiscal balance, are not statistically significant. The latter finding is in line with the conclusions of Taylor (2009) and Spilimbergo et al. (2009). According to Taylor (2009), the government transfers to families in the United States did not increase personal consumption expenditures due to the unpredictability of government policies.

Finally, our results show that countries with higher population growth experienced lower output losses. The magnitude of population growth's coefficients is relatively high ranging from -5.240 to -5.779 (see columns 1-5). However, including population growth does not change the effect of hiring cost on output loss.

We also examine the relationship between labor market flexibility and the duration of the crisis. Table 3.6 column (1) shows that the indicators of labor market flexibility do not have a significant impact on the duration of the crisis. However, after excluding highly insignificant variables, the coefficient of dismissal cost becomes significant with a positive sign (see column 2). This means that low dismissal costs (i.e. more flexibility) slow the recovery from the crisis. This finding is in line with the results of Bentolila and Bertola (1990) and Bertola (1990) that a reduction of firing costs does not increase firms' marginal propensity to hire, but strongly affects their willingness to fire. The results are robust when we include the composition of export as additional control variables (columns 3-5). The magnitude of the coefficient of dismissal cost implies that a one-point increase in the score of this variable (i.e. lower dismissal cost) increases the duration of the crisis by 0.554 quarters. So if a country moved from the lowest (Bolivia) to the highest score of our indicator of dismissal cost (Denmark), its recovery period would increase by 2.060 quarters.

The control variables that are significant are trade barriers, openness, credit growth, stability of inflation, and the exchange rate regime. Countries with more restrictions on international trade tend to recover faster than those with fewer restrictions. As the crisis deepens, there is increasing pressure to raise trade barriers such as non-tariff protection to limit imports, or introduce various forms of export subsidies (see Spilimbergo et al., 2009). However, countries depending on trade will recover faster from the crisis. In addition, countries that had higher credit growth before the crisis take longer to recover. A more flexible exchange rate regime and more stable inflation help the countries to recover faster.

Table 3.5 Estimation Results for Output Loss

Dependent Variable: Percentage change of GDP from the peak to bottom					
VARIABLES	(1)	(2)	(3)	(4)	(5)
Labor Market Regulation	0.004				
	(0.010)				
Dismissal Cost	0.002				
	(0.013)				
Hiring Cost	-0.017	-0.021**	-0.020*	-0.023**	-0.021**
	(0.013)	(0.010)	(0.010)	(0.011)	(0.010)
Trade Barriers	-0.061***	-0.061***	-0.061***	-0.061***	-0.061***
	(0.013)	(0.011)	(0.011)	(0.011)	(0.011)
Openness	0.037**	0.041***	0.038***	0.042***	0.041***
	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
Share of Food in Exports			-0.063		
			(0.101)		
Share of Industrial Goods in Exports				0.031	
				(0.054)	
Share of Fuel in Exports					0.011
					(0.072)
Financial Integration	0.013	0.015**	0.016**	0.015**	0.015**
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Financial Development	-0.026				
	(0.023)				
Log GDP per Capita	-0.007				
	(0.067)				
Credit Growth	0.079*	0.077**	0.084**	0.075**	0.080*
	(0.046)	(0.036)	(0.038)	(0.036)	(0.040)
Stability of Inflation	-0.062***	-0.070***	-0.070***	-0.068***	-0.070***
	(0.018)	(0.015)	(0.015)	(0.015)	(0.015)
Exchange Rate Regime Dummy	0.007				
	(0.026)				
Change of Fiscal Deficit	-0.155				
	(0.375)				
Governance	0.036	0.024	0.022	0.025*	0.024
	(0.025)	(0.014)	(0.015)	(0.015)	(0.015)
Population Growth	-5.779***	-5.440***	-5.240***	-5.452***	-5.438***
	(1.727)	(1.326)	(1.373)	(1.336)	(1.340)
Constant	1.123***	1.120***	1.117***	1.086***	1.112***
	(0.298)	(0.159)	(0.160)	(0.171)	(0.167)
Observations	56	56	56	56	56
R-squared	0.740	0.724	0.727	0.726	0.725

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3.6 Estimation Results for Duration of the Crisis

Dependent Variable: Duration					
VARIABLES	(1)	(2)	(3)	(4)	(5)
Labor Market Regulation	-0.027				
	(0.278)				
Dismissal Cost	0.283	0.554**	0.554**	0.604**	0.554**
	(0.354)	(0.257)	(0.260)	(0.263)	(0.260)
Hiring Cost	-0.047				
	(0.359)				
Trade Barriers	0.643*	0.894***	0.894***	0.921***	0.893***
	(0.358)	(0.220)	(0.223)	(0.223)	(0.227)
Openness	-0.535	-0.857**	-0.855**	-0.820**	-0.858**
	(0.445)	(0.379)	(0.388)	(0.382)	(0.385)
Share of Food in Exports			0.096		
			(2.626)		
Share of Industrial Goods in Exports				1.326	
				(1.416)	
Share of Fuel in Exports					-0.030
					(1.926)
Financial Integration	0.145				
	(0.213)				
Financial Development	0.699				
	(0.629)				
Log GDP per Capita	-0.511				
	(1.838)				
Credit Growth	1.951	1.784*	1.773	1.706	1.777
	(1.256)	(1.033)	(1.082)	(1.038)	(1.148)
Stability of Inflation	-1.295**	-1.237***	-1.237***	-1.141***	-1.238***
	(0.486)	(0.409)	(0.413)	(0.422)	(0.419)
Exchange Rate Regime Dummy	-1.759**	-2.106***	-2.110***	-2.123***	-2.107***
	(0.703)	(0.558)	(0.570)	(0.559)	(0.565)
The Change of Fiscal Deficit	8.121				
	(10.223)				
Governance	0.177				
	(0.688)				
Population Growth	-41.753				
	(47.061)				
Constant	13.583	11.079***	11.072***	9.487**	11.099***
	(8.125)	(3.693)	(3.736)	(4.070)	(3.945)
Observations	56	56	56	56	56
R-squared	0.572	0.525	0.525	0.533	0.525

Standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

3.5 Robustness Tests

In order to check the robustness of estimation results, we employ two methods. First, we exclude the outliers from the estimations. Based on the residuals, Costa Rica, Jamaica, and Latvia were dropped. Second, we separate the sample into high-income countries and other countries. The estimation results are shown in Table 3.7.

Dropping outliers does not affect our main results. The coefficient of hiring cost is still statistically significant with a negative sign (see column 1). It indicates that lower hiring cost (more flexibility) leads to lower output losses. In addition, the dismissal costs remain a significant determinant of the duration of the crisis (see column 2). The countries that have low dismissal cost take longer to recover from the crisis.

When the observations are separated into high-income countries and other countries, it turns out that the results slightly change. Hiring cost significantly affect the output losses only in high-income countries, but not in the other countries (see columns 3 and 5). Still, the magnitude of the coefficient of hiring costs is very similar for both sub-samples; for non-high-income countries the coefficient is, however, estimated less precisely. Meanwhile, the duration of the crisis is affected significantly by the dismissal costs only in the non-high-income countries. The speed of recovery in high-income countries is affected by the other variables such as trade barriers, openness, credit growth, stability of inflation, and the exchange rate regime.

Table 3.7 Robustness Tests

	Without Outliers		High-Income Countries		Other Countries	
	Output Loss	Duration	Output Loss	Duration	Output Loss	Duration
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Labor Market Regulation						
Dismissal Cost		0.500**		0.111		0.795**
		(0.240)		(0.351)		(0.352)
Hiring Cost	-0.021**		-0.018**		-0.017	
	(0.009)		(0.008)		(0.021)	
Trade Barriers	-0.047***	0.657***		1.386**	-0.071***	0.827**
	(0.008)	(0.219)		(0.497)	(0.015)	(0.294)
Openness	0.034***	-0.593		-1.185**	0.051	
	(0.011)	(0.362)		(0.441)	(0.043)	
Financial Integration	0.020***				0.020*	
	(0.006)				(0.011)	
Credit Growth	0.055*	2.284**	0.077**	3.080**	0.094	
	(0.030)	(0.996)	(0.030)	(1.158)	(0.093)	
Stability of Inflation	-0.082***	-0.359	-0.113***	-1.703**	-0.066***	-1.297**
	(0.014)	(0.466)	(0.020)	(0.816)	(0.023)	(0.498)
Exchange Rate Regime Dummy		-1.878***		-2.190***		-1.578*
		(0.534)		(0.653)		(0.808)
Population Growth	-4.377***		-4.843***		-4.825*	
	(1.141)		(1.256)		(2.578)	
Constant	1.097***	4.197	1.202***	12.142	1.084***	10.854**
	(0.118)	(4.050)	(0.191)	(8.103)	(0.231)	(4.754)
Observations	53	53	32	32	24	24
R-squared	0.796	0.528	0.718	0.605	0.775	0.481

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

3.6 The Unemployment Impact of the Financial Crisis and Labor Market Flexibility

Previous research has not examined cross-country differences in unemployment during the crisis. This section follows Artha and De Haan (2011) and analyzes whether cross-country differences in the increase in unemployment are affected by differences in labor market flexibility.

We estimate equation 3.4 using the change of unemployment rate from peak to through during the first quarter of 2007 until the first quarter of 2010 as dependent variable. The peak is defined as the point in time with the lowest level of unemployment, while the through is the point in time with the highest level of unemployment. As not all countries were out of the recession at the end of this period, the impact of the crisis on the change in unemployment may be underestimated. We select control variables based on previous studies like Berkmen et al. (2009) and Artha and De Haan (2011). We employ the data of 50 countries (see Table B.3 in the Appendix for the list of countries).

Table 3.8 provides the estimation results of the effect of labor market flexibility indicators and the other control variables on the employment losses. We followed the general to specific approach to select the control variables to be included. In column (1), we include all observations (50 countries). It turns out that hiring cost is statistically significant with a negative sign. It implies that lower hiring cost (i.e. a more flexible labor market) is related to lower employment losses. According to the estimated coefficient, a one-point increase in the hiring cost score (lower hiring cost) reduces the employment loss during the crisis by about 0.008 points. Hence, if a country moved from the lowest (Spain) to the highest score of our indicator of hiring cost (New Zealand), its unemployment rate would decline by 0.029. However, the other measures of labor market flexibility are not statistically significant. Some control variables, like credit growth and stability of inflation also have a significant effect on the employment loss. High credit growth prior to the crisis is associated with higher employment losses, while our results also suggest that countries with more stable inflation are less affected by the financial crisis.

Table 3.8 Estimation Results for Unemployment

VARIABLES	(1)	(2)	(3)
Labor Market Regulation	--	--	--
Dismissal Cost	--	--	--
Hiring Cost	-0.008**	-0.008*	--
	(0.004)	(0.005)	
Trade Barriers	--	0.020**	--
		(0.009)	
Openness	--	-0.017**	--
		(0.006)	
Credit Growth	0.077***	0.057***	0.097***
	(0.013)	(0.016)	(0.017)
Stability of Inflation	-0.011**	-0.048***	--
	(0.005)	(0.011)	
Governance	--	-0.019**	--
		(0.009)	
Constant	0.138***	0.363***	0.036***
	(0.051)	(0.112)	(0.005)
Observations	50	32	18
R-squared	0.52	0.68	0.68

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Column (1) shows the results for all 50 countries while columns (2) and (3) present the outcomes for industrial and developing countries, respectively.

In column (2) and column (3), we split the sample into industrial and developing countries, respectively. There are 18 developing countries and 32 industrial developed countries. For industrial countries, hiring cost is statistically significant with a negative sign. However, the other two labor market indicators are not statistically significant. The control variables, which are statistically significant are trade barriers, openness, credit growth, stability of inflation, and governance. According to our estimates, fewer restrictions on international trade will lead to higher unemployment due to the financial crisis. However, countries depending on international trade, which is represented by the contribution of export-import to GDP, experience lower employment losses. Countries with high domestic credit growth prior to global financial crisis suffered more. Stability

of inflation has a negative sign, indicating that countries in which the monetary authorities were able to stabilize inflation experienced lower employment losses. In addition, countries with good governance had lower employment losses during the financial crisis. For developing countries (column 3), all labor market flexibility indicators are not significant. Credit growth is the only variable which has a significant effect on the employment loss during the crisis.

3.7 Conclusions

This study examines the relationship between the impact of the global financial crisis and labor market flexibility. By employing cross-country regressions and including control variables such as trade integration, financial integration, financial development, financial vulnerability, policy framework, institutional differences, and population growth, we find that countries with low hiring cost suffered lower output loss due to the recent financial crisis. However, countries with lower dismissal cost recovered slower than countries with higher dismissal cost. The results are robust for exclusion of outliers. Also regulatory trade barriers, openness, credit growth, financial integration, inflation stability, and population growth are found to have a significant impact on output loss. With respect to the speed of recovery from the crisis, we find that apart from labor market flexibility, only trade barriers, credit growth, and exchange rate regimes are statistically significant. Our findings for the total sample suggest that there is a trade-off between the depth of the recession following the crisis and the duration of the recession. A more flexible labor market leads to a smaller output loss, but it also increases the time to recover from the crisis. The results vary somewhat across country groups. Our findings suggest that in high-income countries, more labor market flexibility decreases the output loss, but does not affect the duration of the crisis.

In addition, this chapter also explores the impact of labor market flexibility on differences in the employment loss across countries due to the global financial crisis. Employment loss is measured as the change of unemployment rate from peak to through during the first quarter of 2007 until the first quarter of 2010. By employing cross-

country regressions and including control variables such as trade integration, financial integration, financial development, financial vulnerability, monetary and fiscal policy, institutional differences, and population growth, we find that countries with low hiring cost suffered lower employment losses due to the recent financial crisis. Although significant, the size of the impact is small. Our other measures of labor market flexibility (labor market regulation and dismissal costs) are not related to the employment loss during the crisis. The other control variables which are statistically significant in the full sample of 50 countries are credit growth and stability of inflation. When we split the sample into industrial and developing countries, we find that hiring cost is not statistically significant in developing countries. For these countries, credit growth before the crisis is the only variable that is significant.

Chapter 4

Financial Crises and the Dismissal of Central Bank Governors: New Evidence

> "Politicians are taking bolder actions to influence monetary policy, signaling that the global financial crisis may end up reining in the independence of many central banks." (Hilsenrath et al., 2010).

4.1 Introduction

Until recently, the independence of central banks increased both in industrial and emerging countries. However, according to several observers, the current global financial crisis threatens the independence of central banks (cf. Bordo, 2010). Anecdotal evidence suggests that financial crises may affect central bank independence. For instance, the central bank governor in Argentina was dismissed in 2010 because he refused to use currency reserves to pay off foreign debt. Similarly, Mexico's president appointed a new governor for the Bank of Mexico in 2009, after he clashed with the bank's former governor who was reluctant to cut interest rates after the country was hit hard by the crisis. Hilsenrath et al. (2010) provide other examples.

Up to now, there is hardly any research examining the relationship between financial crises and central bank independence.[19] This chapter examines whether financial crises in general, and currency, debt, and banking crises in particular, affect the likelihood that a central bank governor will be replaced. Following Vuletin and Zhu (2011), this chapter also analyses whether a new central bank governor is more likely to come from the ranks of the executive branch of the government (government ally) or not (non-government ally).

Employing a conditional fixed effects logit model that is similar to that of Dreher et al. (2010) and Klomp and De Haan (2010) for 101 countries during the period 1970-2007, we find that banking crises and debt crises significantly increase the likelihood that a central bank governor will be replaced. This result holds no matter we use all turnovers or only irregular turnovers, i.e. replacements that occur before the legal term in office of the central bank governor had ended. Moreover, using a more limited data set about the nature of a turnover, we find that banking crises increase the likelihood that a non-government ally will be appointed as new central bank governor.

The remainder of the chapter is structured as follows. Section 4.2 outlines our methodology, while section 4.3 describes the data used. Section 4.4 presents the main estimation results, while section 4.5 offers a sensitivity analysis. Section 4.6 presents the outcomes for the nature of the central bank governor replacement and section 4.7 offers some concluding remarks.

[19] Klomp and De Haan (2010) do not investigate the impact of financial crises on the likelihood of a central bank governor turnover, while Dreher et al. (2010) only examine whether currency devaluations affect the likelihood that a central bank governor will be replaced. There are two lines of research on related issues. First, some studies suggest that central bank independence reduces financial instability and the incidence of banking crisis (see Klomp and De Haan, 2009 and Khan et al., forthcoming). Second, there is a substantive amount of research on the drivers of financial crises (see, for instance, Angkinand and Willett, 2011 and Licchetta, 2011).

4.2 Methodology

In order to estimate the effect of financial crises on the probability that a central bank governor will be replaced, we employ a conditional fixed effects logit model. Variants of the following model are estimated:

$$govchange_{it} = \alpha + \beta_1 crisis_{it-1} + \beta_2 elapsed_{it-1} + \beta_3 X_{it-1} + \eta_i + \varepsilon_{it} \quad (4.1)$$

where *govchange* equals 1 if in year *t* at least one central bank governor turnover occurs and is 0 otherwise; *crisis* equals one if a there is a financial (banking, currency or debt) crisis in year *t*; elapsed is the share of the governor's legal term in office that has elapsed; *X* is a vector of control variables; η_i is the country specific (fixed) effect and ε_{it} is an i.i.d disturbance term. We include the *share of* the official *time* in office that has *elapsed* as it becomes more likely that a central bank governor will be replaced if a larger part of the legal term in office has elapsed (Dreher et al., 2010 and Klomp and De Haan, 2010). In the models as discussed in section 4.6, *govchange* is a dummy variable that is one when the new central bank governor is a non-government ally and zero otherwise.

We follow Dreher et al. (2010) and Klomp and De Haan (2010), but extend their work in different directions. First, we examine the effect of financial crises on the likelihood that a central bank governor will be replaced. Second, we examine whether central bank independence and inflation-targeting mediate the effect of financial crises on a central bank governor turnover. Third, we estimate equation (4.1) by employing conditional logit models with clustered standard errors given the inertial nature of the variables involved. Finally, following Vuletin and Zhu (2011), we investigate whether the new governor who is appointed after the occurrence of a financial crisis is an ally of the government or not.

As control variables, we include several economic and political variables that Dreher et al. (2010) and Klomp and De Haan (2010) consider. In addition, we include legal independence of the central bank as well as a dummy that is one if the country concerned has an inflation-targeting regime. The lags of all explanatory variables are used in all estimations in order to avoid endogeneity problems.

As to the economic controls: Inflation is expected to have a positive effect on the probability of a central bank governor turnover because the central bank governor may be held responsible for high rates of inflation. Dreher et al. (2010) argue that more restrictions on international transactions increase the probability that a central bank governor will be replaced. Moreover, a higher degree of openness reduces the inflationary bias and therefore reduces the incentive to commit for the government. Finally, countries with a more developed financial sector are less likely to face a situation of fiscal dominance (Sargent and Wallace, 1981).

As to the political controls: elections are predicted to have a positive impact on the probability that the central bank governor will be replaced. A newly elected government may prefer to appoint a new central bank governor who is more closely aligned to those in power. For similar reasons, political and regime instability, for which we use several proxies as explained in section 4.3, are expected to increase the likelihood that a new central bank governor will be appointed (Dreher et al., 2010). The ideological position of the party in government is included to test for possible partisan effects. Following Dreher et al. (2010), also several dimensions of the political system in place are considered, such as the presence of a system with many checks and balances, a bi-cameral political system, and a federal political system. Countries with a political system with strong checks and balances have more independent central banks compared to those with weak or no checks and balances. Likewise, countries with a bi-cameral or a federal political system tend to have an independent central bank (see Bernhard, 1998) in which it may therefore be harder to replace a central bank governor.

In addition to the variables considered in previous studies, we also include the legal independence of the central bank and the presence of an inflation-targeting regime. When a central bank is legally independent, it will be difficult for the government to replace the central bank governor. For similar reasons we include a dummy that is one if the central bank has an inflation-targeting strategy, and zero otherwise. Under an inflation-targeting regime, arguably only a poor inflation record can be ground for dismissal of the central bank governor.

Both central bank independence and the presence of an inflation-targeting regime may condition the impact of a financial crisis on the probability that a central bank governor will be replaced. The effect of a financial crisis on the likelihood of a turnover of the central bank governor is expected to be diminishing in central bank independence and the presence of an inflation-targeting regime. In order to test for this conditionality, we include two interaction terms: between financial crisis and legal independence of the central bank, and between financial crisis and the dummy for the presence of an inflation-targeting regime.

As Ai and Norton (2003) and Greene (2010) show, the statistical significance of an interaction effect cannot be tested with a simple t-test on the coefficient of the interaction term, but must be based on the estimated cross-partial derivative. Following the methodology suggested by Ai and Norton (2003) and Greene (2010), we compute the estimated coefficient and standard error of the *average* marginal effect as well as the individual-specific estimate and standard error for each observation. Moreover, we also use a graphical device to interpret the marginal effect of interaction terms since it is much more informative than test statistics (see Greene, 2010).

4.3 Data

Information on central bank governor turnovers and their legal term in office is taken from the KOF Swiss Economic Institute website.[20] The sample period is 1970-2007. We include 101 countries for which data on financial crises is available for that period (see Table C.1 in the Appendix for the list of countries included). In our sample, central bank governors remain in office on average for 3.49 years, while turnovers occur in 21.7% of the country-years. In section 4.6, we examine the nature of a central bank governor's replacement for 40 countries during 1972-2006 using the data from Vuletin and Zhu (2011).[21]

[20] See http://www.kof.ethz.ch/en/indicators/data-central-bank-governors/
[21] We thank the authors for providing their data.

The summary statistics for all explanatory variables are presented in Table 4.1. Financial crises data come from Laeven and Valencia (2008). Financial crises are divided into 3 categories: banking, currency and debt crises. A banking crisis occurs if a country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. A currency crisis occurs in case the currency depreciates by at least 30 percent, while a debt crisis is identified by sovereign debt default and restructuring. In our sample, there are 83 banking crises, 130 currency crises and 37 debt crises. Years during which one or more of these crises happen are given score 1; otherwise the variable *financial crisis* is zero. In addition, we construct similar dummy variables for each type of financial crisis.

As economic controls we include inflation, openness, trade restrictions, and financial development. Data on *inflation* come from the World Bank (2010). To reduce the influence of extreme observations, the inflation rate p is transformed as follows: $(p/100)/(1-p/100)=\pi$. *Openness* is measured by the ratio of exports plus imports to GDP drawn from the World Bank (2010). *Trade restrictions* is the weighted average of some variables such as hidden import barriers, mean tariff rate, taxes on international trade, and capital account restrictions drawn from the KOF index of globalization.[22] The level of *financial development* is measured as the ratio of private credit to GDP. The data is provided by Beck and Demirgüc-Kunt (2009).

We also include several political variables. Our elections variable is based on the number of the month (M) when presidential/parliamentary elections are held. In an election year, the variable *election* is measured as $M/12$ and in a pre-election year as $(12-M)/12$. The information on elections comes from Beck et al. (2001). In addition, we include a dummy *new government* that is one if there is a new chief executive (source: Databanks International, 2010) and the variable *percentage of veto players who drop* (source: Beck et al., 2001). The latter is a proxy for instability within the political regime in place. We use three indicators of regime instability. First, following Dreher et al.

[22] See http://globalization.kof.ethz.ch/.

(2010), *regime instability* is the first principal component of a number of regime instability indicators from Databanks International (2010): revolutions, purges, riots, strikes, assassinations, guerilla warfare, major crises, and the number of (successful) coups d'états. Second, *change in democracy* is a dummy that is one if the Polity index changes by more than three points (source: Marshall et al., 2010). Third, we use the number of (attempted) *coups* including unsuccessful coups (source: Marshall and Marshall, 2011).

The dummy variable *left government* comes from updates of Beck et al. (2001); it is 1 if the main party in government is a left-wing party, otherwise it is zero. In addition, we include the variable *checks and balances* provided by Beck et al. (2001), a dummy variable *autonomous regions* indicating the existence of autonomous regions, and a dummy variable *two assemblies* indicating of the presence of two chambers in the national assembly (source: Beck et al., 2001).

Monetary policy arrangements are captured by two variables: central bank independence and a dummy for the presence of an inflation targeting strategy. *Central bank independence* is proxied by a legal independence index using data provided by Arnone et al. (2007) for the period 1980 and 2003. Since the index of Arnone et al. (2007) refers to two points in time only, we construct time series for the index using information about the timing of central bank reform provided by Acemoglu et al. (2008). Using the year in which central bank reform took place, we can determine when legal central bank independence has changed during the period 1980-2005. To extend the index to 2007, we checked whether central bank legislation has been changed between 2005 and 2007 using the website of each central bank. The index has been extended for the period before 1980 by checking whether any central bank law reform took place between 1970 and 1980. For that purpose, we compare data on legal independence of Cukierman et al. (1992) and Polillo and Guillén (2005). If legal independence before and after 1989 is the same, we use Arnone's value of the legal index for 1980 also for the period 1970-1980. The data for the adoption of *inflation targeting* is taken from Samaryna and De Haan (2011), Leyva (2008), and Roger (2009).

Table 4.1 Summary Statistics

Variables:	All Countries			Industrial Countries			Developing Countries		
	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.
Term in office (years)	3.49	0.00	29.00	4.07	0.00	29.00	3.19	0.00	28.00
Share of time elapsed	0.62	0.00	5.67	0.69	0.00	5.67	0.58	0.00	5.60
Financial crisis									
Financial crisis	0.06	0.00	1.00	0.02	0.00	1.00	0.08	0.00	1.00
Banking crisis	0.02	0.00	1.00	0.01	0.00	1.00	0.03	0.00	1.00
Currency crisis	0.03	0.00	1.00	0.01	0.00	1.00	0.05	0.00	1.00
Debt crisis	0.01	0.00	1.00	0.00	0.00	1.00	0.01	0.00	1.00
Economic Factors									
Inflation	0.11	-0.28	0.99	0.07	-0.28	0.94	0.14	-0.13	0.99
Openness	0.72	0.05	4.39	0.83	0.11	4.39	0.67	0.05	3.75
Trade restrictions	52.69	5.39	97.69	76.72	32.00	97.69	40.33	5.39	85.60
Financial development	0.45	0.01	2.70	0.74	0.07	2.70	0.27	0.01	1.66
Political Factors									
Election	0.21	0.00	1.40	0.25	0.00	1.00	0.19	0.00	1.00
New government	0.19	0.00	1.00	0.23	0.00	1.00	0.17	0.00	1.00
Percentage of veto players who drop	0.13	0.00	1.00	0.13	0.00	1.00	0.13	0.00	1.00
Regime instability	0.01	-0.52	10.92	-0.20	-0.52	5.14	0.11	-0.52	10.92
Change in democracy	0.60	0.00	1.00	0.85	0.00	1.00	0.48	0.00	1.00
Coups	0.06	0.00	3.00	0.01	0.00	3.00	0.08	0.00	3.00
Left government	0.29	0.00	1.00	0.37	0.00	1.00	0.25	0.00	1.00
Checks and balances	3.00	1.00	18.00	3.90	1.00	16.00	2.54	0.00	18.00
Autonomous regions	0.14	0.00	1.00	0.24	0.00	1.00	0.08	0.00	1.00
Two assemblies	0.54	0.00	1.00	0.89	0.00	1.00	0.36	0.00	1.00
Monetary Policy Arrangements									
Central bank independence	0.46	0.09	1.00	0.53	0.09	1.00	0.43	0.09	0.94
Inflation targeting	0.06	0.00	1.00	0.15	0.00	1.00	0.03	0.00	1.00
Number of countries	101	101	101	34	34	34	67	67	67
The nature of central bank governor replacement									
A government ally	0.01	0.00	1.00	0.00	0.00	1.00	0.02	0.00	1.00
Non-government ally	0.18	0.00	1.00	0.15	0.00	1.00	0.22	0.00	1.00
Number of countries	42	42	42	24	24	24	18	18	18

4.4 Estimation Results

Table 4.2 shows the estimation results of equation (4.1). We start with a model with financial crises and the share of time elapsed as explanatory variables. In columns (2)-(17), each variable as described in section 4.3 is added one at the time. In all regressions the coefficients of financial crisis and time elapsed are significant at the one percent level with the expected positive sign.

The other control variables which are statistically significant are inflation, elections, coups, trade restrictions, new government, regime instability, central bank independence, and inflation targeting. As expected, inflation has a positive and statistically significant effect on the likelihood of a central bank governor turnover. Elections, coups, new government, and regime instability also increase the likelihood of a central bank governor turnover, while trade restrictions reduce this likelihood. The presence of an independent central bank and an inflation-targeting regime reduce the likelihood that a new central bank governor will be appointed.

When all explanatory variables are included simultaneously in the model (column 18), the coefficients of several variables turn insignificant. We rerun the model several times, every time dropping the least significant variable until all remaining variables are significant. The result is shown in column (19) of Table 4.2. The coefficient of financial crises remains statistically significant with a positive sign.

Table 4.2 Effect of Financial Crises on the Likelihood that CB Governor will be Replaced (Conditional Logit Model)

	1	2	3	4	5	6	7	8	9
Financial Crisis	0.711***	0.390**	0.714***	0.663***	0.709***	0.647***	0.693***	0.718***	0.685***
	(0.182)	(0.187)	(0.194)	(0.198)	(0.184)	(0.183)	(0.183)	(0.181)	(0.181)
Share of term elapsed	0.548***	0.688***	0.546***	0.621***	0.633***	0.566***	0.629***	0.652***	0.632***
	(0.166)	(0.221)	(0.185)	(0.220)	(0.183)	(0.180)	(0.183)	(0.192)	(0.182)
Inflation		1.375***							
		(0.338)							
Election			0.687***						
			(0.177)						
Percentage of veto players who drop				0.136					
				(0.179)					
Coups					0.332*				
					(0.177)				
Capital control						-0.010*			
						(0.006)			
New government							0.226**		
							(0.111)		
Change in democracy								0.037	
								(0.166)	
Political Instability									0.160***
									(0.047)
Number of Observation	3298	2922	2923	2614	3266	3183	3206	3099	3226
Number of countries	101	101	101	101	101	101	101	101	101
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Estimates of equation 4.1. Dependent variable: dummy that equals 1 if in year *t* at least one central bank governor turnover occurs and is 0 otherwise. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The null hypothesis of the Prob > chi2 is that all regression coefficients in the model are equal to zero.

	10	11	12	13	14	15	16	17	18	19
Financial Crisis	0.651***	0.685***	0.723***	0.625***	0.659***	0.708***	0.721***	0.692***	0.638***	0.472**
	(0.208)	(0.196)	(0.183)	(0.201)	(0.195)	(0.196)	(0.193)	(0.179)	(0.240)	(0.215)
Share of term elapsed	0.663***	0.616***	0.630***	0.600***	0.616***	0.614***	0.875***	0.548***	1.172***	1.055***
	(0.222)	(0.208)	(0.179)	(0.214)	(0.208)	(0.207)	(0.150)	(0.167)	(0.186)	(0.164)
Inflation									1.539***	1.623***
									(0.440)	(0.428)
Election									0.782***	0.742***
									(0.205)	(0.191)
Percentage of veto players who drop									-0.430*	
									(0.242)	
Coups									-0.080	
									(0.235)	
Capital control									-0.008	
									(0.011)	
New government									0.064	
									(0.167)	
Change in democracy									0.413	
									(0.284)	
Political Instability									0.039	
									(0.084)	
Private credit	-0.156								-0.028	
	(0.277)								(0.448)	
Left Government		0.026							0.237	
		(0.124)							(0.172)	
Openness			0.291						0.146	
			(0.329)						(0.488)	

Check and balances				-0.060					-0.074	
				(0.042)					(0.049)	
Autonomous regions					-0.091				0.128	
					(0.163)				(0.204)	
Two assemblies						-0.246			-0.476	
						(0.267)			(0.383)	
CBI							-1.430***		-0.631	-0.886*
							(0.502)		(0.620)	(0.511)
Inflation targeting								-0.387*	-0.079	
								(0.200)	(0.301)	
Number of Observation	2741	2810	3130	2710	2811	2816	2714	3298	1814	2305
Number of countries	101	101	101	101	101	101	101	101	101	101
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Estimates of equation 4.1. Dependent variable: dummy that equals 1 if in year *t* at least one central bank governor turnover occurs and is 0 otherwise. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The null hypothesis of the Prob > chi2 is that all regression coefficients in the model are equal to zero.

Our results for the control variables that turn out to be significant are in line with those of previous studies (Dreher et al., 2010 and Klomp and De Haan, 2010). In particular, we find that the share of time elapsed is statistically significant with a positive sign, i.e. if a larger part of the legal term in office has elapsed, there is a higher likelihood that a central bank governor will be replaced. Inflation and elections have a positive and statistically significant effect on the likelihood of a central bank governor turnover, while central bank independence has a negative relationship with the likelihood that a central bank governor will be replaced.

In order to check for heterogeneity, the sample is separated into industrial and developing countries. Column (2) of Table 4.3 presents the estimation results for industrial countries. It turns out that in this sample financial crises significantly increase the likelihood that a central bank governor will be replaced. The marginal effect (shown in squared brackets) suggests that a financial crisis increases the likelihood of a governor turnover by 16.9 percentage points in industrial countries. The other variables that are significant are the share of time in office that has elapsed and elections.

The estimation results in column (3) show that in developing countries financial crises increase the probability that a central bank governor will be replaced by 9.2 percentage points. Most other variables (the share of time elapsed, inflation, and elections) are also statistically significant, but the legal independence of the central bank does not have a significant effect on the likelihood of a central bank governor turnover.

To examine whether the effect of financial crises on the probability that a central bank governor will be replaced is conditioned by central bank independence, we include the interaction term of financial crisis and the legal independence index in column (4) of Table 4.3. It turns out that the interaction term is not statistically significant, while also the coefficient of financial crisis becomes insignificant. However, the marginal effect of financial crisis on the replacement of central bank governor is statistically significant. The occurrence of financial crisis increases the probability that a central bank governor will be replaced by 9.6 percentage points.

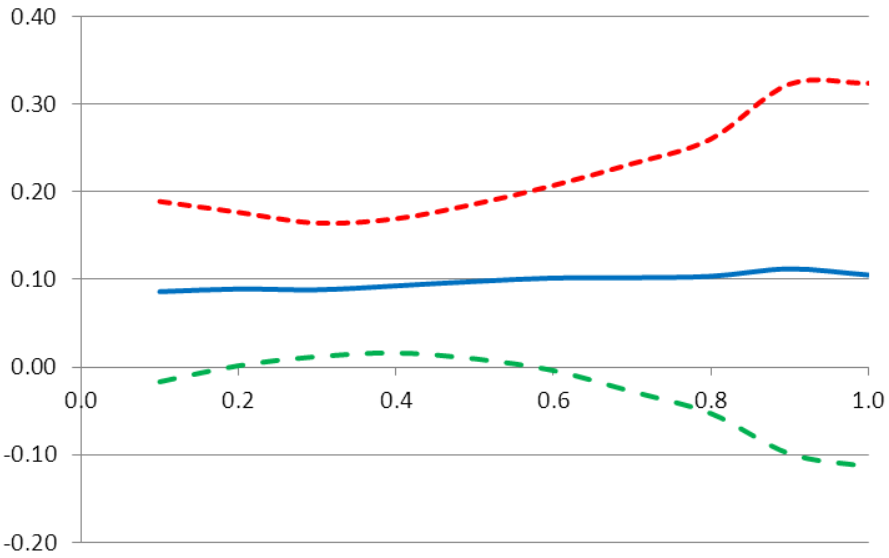
Table 4.3 Effect of Financial Crises on the Likelihood that CB Governor will be Replaced (Different Samples and Interaction Effects)

	(1)	(2)	(3)	(4)	(5)
Financial crisis	0.472**	0.835**	0.395	0.466	0.397*
	(0.215)	(0.414)	(0.251)	(0.368)	(0.207)
	[0.100]**	[0.169]**	[0.092]*	[0.096]**	[0.078]**
Share of time elapsed	1.055***	0.930***	1.141***	1.055***	0.699***
	(0.164)	(0.304)	(0.164)	(0.164)	(0.259)
	[0.241]***	[0.217]***	[0.276]***	[0.225]**	[0.147]
Inflation	1.623***	0.855	1.750***	1.623***	1.510***
	(0.428)	(0.955)	(0.457)	(0.429)	(0.383)
	[0.370]***	[0.199]	[0.423]***	[0.345]***	[0.317]***
Election	0.742***	0.476**	0.894***	0.742***	0.682***
	(0.191)	(0.230)	(0.254)	(0.191)	(0.180)
	[0.169]***	[0.111]**	[0.216]***	[0.158]	[0.143]
Central bank independence	-0.886*	-0.614	-1.676	-0.887*	
	(0.511)	(0.505)	(1.177)	(0.522)	
	[-0.202]	[-0.143]	[-0.405]	[-0.189]	
Financial crisis x Central bank independence				0.013	
				(0.780)	
Inflation targeting					-0.201
					(0.218)
					[-0.044]
Financial Crisis x Inflation targeting					-0.044
					(1.056)
Number of observations	2305	921	1384	2305	2624
Number of countries	101	34	67	101	101
Prob>Chi2	0.000	0.000	0.000	0.000	0.000

*** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in squared brackets is the marginal effect. Estimation results are for the full sample, except for columns (2) and (3) which refer to industrial and developing countries, respectively. Columns (4) and (5) include interaction terms. Column (1) corresponds to column (19) of Table 4.2. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

Following Greene (2010), we interpret the interaction effects by plotting the marginal effect of financial crisis and the degree of legal independence of central bank. Figure 4.1 shows the effect of financial crises on the likelihood that the central bank governor will be replaced (vertical axis), conditional on the degree of central bank independence (horizontal axis).

Figure 4.1 The Effect of Financial Crises on the Likelihood of a Central Bank Governor Change Conditional on Central Bank Independence



Note: The dotted lines indicate the 95% significance interval. When the both lines of the significance interval are below or above zero, the marginal effect of financial crisis is significant).

It follows from Figure 4.1 that the marginal effect of a financial crisis on the probability of a central bank governor replacement is positive and significant when the legal index of central bank independence is between 0.2 and 0.6. When the central bank is highly independent (index is higher than 0.6), the effect of a financial crisis on the probability that the central bank governor will be replaced becomes insignificant. Since the interaction term in equation (4) is not statistically significant, the marginal effect of

financial crises tends to be flat over the legal independence index (shown by the solid line).

In column (5) of Table 4.3, we include the interaction term of financial crisis and inflation targeting. The results show that the interaction term is not statistically significant. However, the marginal effect of a financial crisis on the likelihood of a central bank governor will be replaced is still statistically significant.

Next, we decompose financial crises into banking crises, currency crises, and debt crises (see Table 4.4). The results in column (1) suggest that banking crises and debt crises affect the likelihood of a central bank governor turnover, in contrast to currency crises. The latter result is in line with the findings of Dreher et al. (2010). Other variables which turn out to be significant are the share of time in office elapsed, inflation, elections, and central bank independence. In column (2) we exclude currency crisis.

In columns (3) and (4) of Table 4.4 we split the sample into industrial countries and developing countries. In industrial countries, a banking crisis does not significantly affect the probability that the central bank governor will be replaced. However, according to the marginal effect, the occurrence of a banking crisis increases the likelihood of a governor turnover by 19.7 percentage points. We do not include the debt crisis dummy into the model of industrial countries because these countries had no debt crisis during the period 1970-2007. In developing countries the occurrence of both a banking crisis and a debt crisis significantly increase the likelihood that the central bank governor will be replaced. A banking crisis increases the likelihood that a central bank governor will be replaced by 18.5 percentage points, while a debt crisis increases this likelihood by 15.7 percentage points.

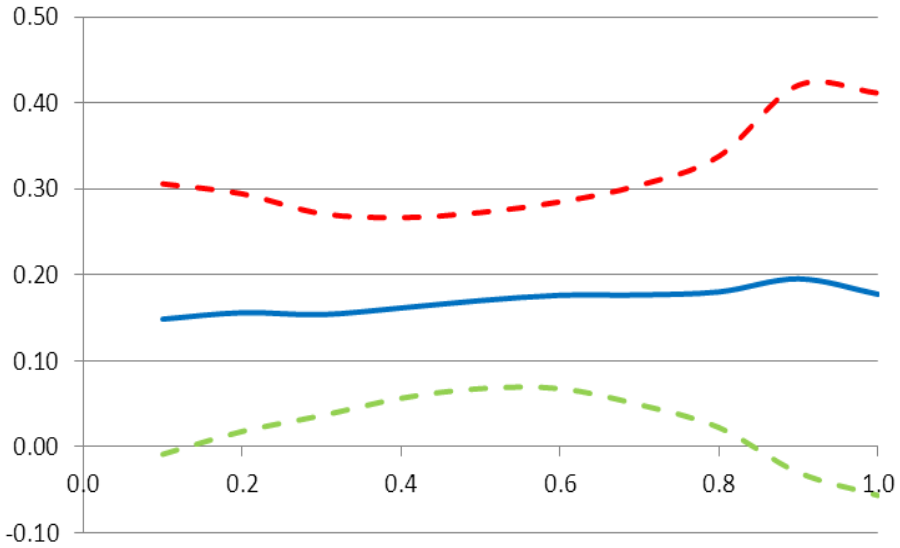
Table 4.4 Effect of Banking, Debt, and Currency Crises on the Likelihood that CB Governor will be Replaced (Different Samples and Interaction Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Banking crisis	0.887***	0.887***	1.020	0.862***	0.915	0.861***
	(0.299)	(0.300)	(0.670)	(0.337)	(0.708)	(0.303)
	[0.171]***	[0.171]***	[0.197]*	[0.185]***	[0.167]***	[0.165]***
Debt crisis	0.638*	0.639*		0.713*	0.639*	-1.028
	(0.380)	(0.372)		(0.385)	(0.369)	(1.386)
	[0.129]*	[0.130]**		[0.157]**	[0.125]*	[0.132]
Currency crisis	0.002					
	(0.261)					
	[0.000]					
Share of time elapsed	1.057***	1.057***	0.940***	1.145***	1.057***	1.058***
	(0.165)	(0.165)	(0.302)	(0.167)	(0.165)	(0.166)
	[0.241]***	[0.241]***	[0.219]***	[0.277]***	[0.225]	[0.226]*
Inflation	1.703***	1.704***	1.081	1.792***	1.703***	1.701***
	(0.426)	(0.434)	(0.865)	(0.474)	(0.438)	(0.442)
	[0.389]***	[0.389]***	[0.252]	[0.434]***	[0.362]***	[0.363]***
Election	0.743***	0.743***	0.448	0.903***	0.743***	0.731***
	(0.192)	(0.192)	0.240	(0.256)	(0.192)	(0.194)
	[0.170]***	[0.169]***	[0.104]*	[0.219]***	[0.158]	[0.156]
Central bank independence	-0.910*	-0.910*	-0.627*	-1.737	-0.908*	-0.960*
	(0.511)	(0.511)	(0.497)	(1.154)	(0.516)	(0.521)
	[-0.208]	[-0.208]	[-0.146]	[-0.420]	[-0.193]	[-0.198]*
Banking crisis x Central bank independence					-0.060	
					(1.194)	
Debt crisis x Central bank independence						3.714
						(2.888)
Number of observations	2305	2305	921	1384	2305	2305
Number of countries	101	101	34	67	101	101
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000

*** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in the squared brackets is the marginal effect. All estimation results are for the full sample, except columns (3) and (4) which refer to industrial and developing countries, respectively. Columns (5) and (6) include interaction terms. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

In columns (5) and (6) of Table 4.4 we include interaction terms for banking crises and central bank independence, and debt crises and central bank independence, respectively. The interaction term for banking crises and central bank independence is not statistically significant, but the marginal effect of banking crises on the replacement of a governor is still statistically significant. In contrast, both the interaction terms and the marginal effect of the debt crisis are not statistically significant.

Figure 4.2 The Effect of Banking Crises on the Likelihood of a Central Bank Governor Change Conditional on Central Bank Independence



Note: The dotted lines indicate the 95% significance interval. When both lines of the significance interval are below or above zero, the marginal effect of financial crisis is significant).

Figure 4.2 shows the marginal effect of a banking crisis on the likelihood of a governor replacement over the range of the legal central bank independence index. The marginal effect of a banking crisis on the likelihood of a governor replacement is statistically significant when the legal CBI index is lower than 0.8. Because the

interaction term in column (5) of Table 4.4 is not statistically significant, the marginal effect of financial crises tends to be flat over the legal independence index (shown by the solid line).

4.5 Robustness Tests

So far, we have considered all changes of central bank governors. It may, however, be argued that a distinction should be made between regular and irregular changes, where the latter is defined as a turnover that take place before the legal term in office of the central bank governor has ended. As a robustness test we therefore use only irregular changes as the dependent variable in Table 4.5. We still find that financial crises significantly affect the likelihood of a central bank governor replacement. Also other variables, such as the share of time elapsed, inflation, elections, and central bank independence, remain significant.

When we split the countries into industrial and developing countries, the effect of a financial crisis on the irregular replacement of central bank governor is significant in industrial countries (see column (2) of Table 4.5), but not in developing countries (column 3). However, the marginal effect of financial crises on a central bank governor replacement is statistically significant both in industrial and developing countries. The other factors that are significant in the model estimated for the sample of developing countries are share of time elapsed, inflation, and elections.

When we consider specific types of financial crises, banking crises and debt crises are significantly affecting the probability of a central bank governor replacement (see column (1) of Table 4.6). The marginal effects indicates that a banking crisis increases the likelihood that the governor will be replaced before his term ends by 18.4 percentage points, while a debt crisis increases this likelihood by 15.2 percentage points.

Table 4.5 Robustness Test Using Irregular Replacements of a Central Bank Governor

	(1)	(2)	(3)
Financial crisis	0.436**	0.799*	0.366
	(0.207)	(0.436)	(0.235)
	[0.099]**	[0.177]**	[0.087]*
Share of time elapsed	0.858***	0.680***	0.980***
	(0.139)	(0.226)	(0.145)
	[0.205]***	[0.166]***	[0.240]***
Inflation	1.619***	1.171	1.711***
	(0.462)	(1.147)	(0.493)
	[0.387]***	[0.286]	[0.419]***
Election	0.778***	0.562*	0.884***
	(0.211)	(0.311)	(0.265)
	[0.186]***	[0.137]*	[0.217]***
Central bank independence	-1.073*	-0.834	-1.648
	(0.607)	(0.594)	(1.423)
	[-0.257]	[-0.204]	[-0.404]
Number of observations	2223	844	1379
Number of countries	101	34	67
Prob>Chi2	0.000	0.000	0.000

*** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in the squared brackets is the marginal effect. Estimation results in columns (1) are for the full sample. Columns (2) and (3) refer to industrial and developing countries, respectively. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

A significant effect of banking crisis on the likelihood of irregular central bank replacement is robust for both developing and developed countries (see columns (2) and (3) of Table 4.6). The other variables such as inflation and elections are also significantly determining the probability of a governor replacement in developing countries, but not in industrial countries.

Finally, we have examined whether there is a systematic difference between countries where the central bank is in charge of banking supervision and countries where some other institutions is charged with this responsibility.[23] The data on banking supervision come from the World Bank (2008) and Masciandaro and Quintyn (2009) from 1998 to 2007 and refer to 57 countries. We find that the probability that a central bank governor will be replaced is not statistically different between countries where a central bank is responsible for banking supervision and the countries where another institution is responsible for banking supervision (results available on request).

[23] Several studies (including Peek et al., 1999; Di Noia and Di Giorgio, 1999; and Masciandaro, 2007) examine the advantage and disadvantage of having the central bank in charge of banking supervision.

Table 4.6 Robustness Test Using Irregular Replacement of a Central Bank Governor and Different Types of Financial Crises

	(1)	(2)	(3)
Banking crisis	0.878***	1.230*	0.795**
	(0.309)	(0.706)	(0.342)
	[0.184]***	[0.250]**	[0.178]***
Debt crisis	0.706*		0.812*
	(0.395)		(0.409)
	[0.152]**		[0.181]**
Share of time elapsed	0.862***	0.690***	0.987***
	(0.141)	(0.226)	(0.148)
	[0.207]***	[0.169]***	[0.242]***
Inflation	1.683***	1.361	1.743***
	(0.460)	(1.148)	(0.492)
	[0.403]***	[0.333]	[0.428]***
Election	0.781***	0.527	0.893***
	(0.214)	(0.321)	(0.271)
	[0.187]***	[0.129]*	[0.219]***
Central bank independence	-1.109*	-0.854	-1.729
	(0.605)	(0.594)	(1.385)
	[-0.266]*	[-0.209]	[-0.425]
Number of observations	2223	844	1379
Number of countries	101	34	67
Prob>Chi2	0.000	0.000	0.000

*** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in the squared brackets is the marginal effect. Estimation results in columns (1) are for the full sample. Columns (2) and (3) refer to industrial and developing countries, respectively. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

4.6 The Nature of a Central Bank Governor Replacement

Our results suggest that the occurrence of a financial crisis, notably a banking or debt crisis, increases the likelihood that the central bank governor will be replaced. Following Vuletin and Zhu (2011), we finally differentiate between new governors drawn from the ranks of the executive branch of the government (government ally) and new governors who come from outside the executive branch (non-government ally). We investigate whether financial crises increase the probability of appointing a non-government ally, considering all turnovers and irregular turnovers only. Our hypothesis is that in order to increase credibility, it may be more attractive for a government to appoint a non-ally as central bank governor after a financial crisis has occurred.

Table 4.7 presents the estimation results for a conditional logit model with clustered robust standard errors. Column (1) shows that financial crises increase the probability that a non-government ally will be chosen as a central bank governor. Also inflation significantly increases the probability that a non-government ally will be appointed as a new central bank governor. The results for the samples of industrial and developing countries (shown in column (2) and (3), respectively) suggest that financial crises are statistically significant for developing countries only. However, the marginal effects of a financial crisis on the probability that a non-government ally will be appointed are significant both in industrial and developing countries.

Decomposing financial crises into bank crises, debt crises, and currency crises, we find that only banking crises significantly affect the probability that a non-government ally will be appointed as a central bank governor (see column (4) of Table 4.7). Similar results are found for the sample of industrial and developing countries (see columns (5) and (6) of Table 4.7).

Table 4.7 Financial Crises and the Nature of Central Bank Governor Replacement(Dependent variable: Non-Government Ally Appointed as New Governor)

	(1)	(2)	(3)	(4)	(5)	(6)
Financial crisis	0.981***	1.097	0.939**			
	(0.358)	(0.743)	(0.402)			
	[0.186]***	[0.221]*	[0.144]*			
Banking crisis				1.613***	1.399*	1.688***
				(0.387)	(0.816)	(0.449)
				[0.261]***	[0.267]**	[0.199]*
Debt crisis				0.238		0.430
				(0.517)		(0.491)
				[0.052]		[0.071]
Currency crisis				0.063	0.859	-0.169
				(0.482)	(1.130)	(0.507)
				[0.014]	[0.184]	[-0.032]
Share of time elapsed	0.823***	0.781**	0.898***	0.809***	0.776**	0.854***
	(0.238)	(0.327)	(0.325)	(0.227)	(0.321)	(0.325)
	[0.186]***	[0.188]**	[0.168]**	[0.184]***	[0.188]**	[0.158]**
Inflation	1.778***	3.302***	1.804*	2.004***	3.191***	2.160**
	(0.670)	(0.847)	(0.938)	(0.677)	(0.839)	(0.959)
	[0.402]***	[0.793]***	[0.338]***	[0.456]***	[0.772]***	[0.399]***
Election	0.423	0.351	0.480	0.419	0.334	0.517
	(0.307)	(0.285)	(0.553)	(0.312)	(0.287)	(0.567)
	[0.096]	[0.084]	[0.090]	[0.095]	[0.081]	[0.095]
Central bank independence	-0.538	-1.034	0.278	-0.596	-1.086	0.292
	(0.733)	(0.855)	(1.325)	(0.726)	(0.857)	(1.273)
	[-0.122]	[-0.248]	[0.052]	[-0.136]	[-0.263]	[0.054]
Number of observations	961	531	430	961	531	430
Number of countries	40	22	18	40	22	18
Prob>Chi2	0.000	0.000	0.002	0.000	0.000	0.000

*** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in the squared brackets is the marginal effect. Estimation results in columns (1) and (4) are for the full sample. Columns (2) and (5) refer to industrial countries, respectively. Columns (3) and (6) refer to developing countries. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

Finally, we investigate the effect of a financial crisis on the possibility that a non-government ally will be appointed after an irregular replacement of the central bank governor. The results are shown in Table 4.8. As there are insufficient observations for irregular changes in the sample of industrial countries, we refrain from estimating this model for industrial countries. The estimation results for the full sample (column 1) suggest that financial crises increase the probability that a non-government ally will be appointed after an irregular replacement of the central bank governor. The same result holds for the sample of developing countries (column 2). When we consider specific types of financial crises, it turns out that banking crises significantly increasing the probability that a non-government ally will be appointed as new governor after the crisis. However, debt and currency crises are not found to be significant (column 3). The same result holds for the sample of developing countries (column 4).

Table 4.8 Financial Crises and the Nature of Central Bank Governor Replacement (Irregular Replacement with a Non-Government Ally as a Dependent Variable)

	(1)	(2)	(3)	(4)
Financial crisis	1.078**	1.077**		
	(0.446)	(0.508)		
	[0.262]**	[0.166]		
Banking crisis			1.796***	1.844***
			(0.532)	(0.611)
			[0.412]***	[0.234]
Debt crisis			0.483	0.779
			(0.589)	(0.614)
			[0.118]	[0.128]
Currency crisis			-0.059	-0.240
			(0.415)	(0.416)
			[-0.014]	[-0.050]
Share of time elapsed	-1.133**	-0.676	-1.282***	-0.883
	(0.469)	(0.570)	(0.479)	(0.612)
	[-0.275]***	[-0.130]	[-0.302]***	[-0.176]
Inflation	1.898**	2.486**	2.122***	2.904***
	(0.752)	(1.069)	(0.780)	(1.110)
	[0.461]**	[0.479]***	[0.500]**	[0.579]***
Election	1.002**	0.952	1.045**	1.070
	(0.496)	(0.771)	(0.505)	(0.783)
	[0.243]*	[0.184]	[0.246]*	[0.213]
Central bank independence	-0.672	1.280	-0.888	1.161
	(1.243)	(1.740)	(1.266)	(1.681)
	[-0.163]	[0.247]	[-0.209]	[0.231]
Number of observations	680	368	680	368
Number of countries	40	18	40	18
Prob>Chi2	0.000	0.002	0.000	0.000

***indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10% level. The number in parentheses is the robust (adjusted) standard error. The number in the squared brackets is the marginal effect. Estimation results in columns (1) and (3) are for the full sample, while columns (2) and (4) refer to developing countries. The null hypothesis of the Prob > chi2 is that all of the regression coefficients in the model are equal to zero.

4.7 Conclusions

This chapter examines the effect of financial crises on the likelihood that a central bank governor will be replaced. Employing a conditional fixed effects logit model with clustered robust standard errors and using a model that is similar to that of Dreher et al. (2010) and Klomp and De Haan (2010) for 101 countries during the period 1970-2007, we find that financial crises make a central bank governor turnover more likely. When we decompose crises into banking, currency, and debt crises, we find that banking and debt crises significantly increase the likelihood of a central bank governor turnover, in contrast to currency crises. There is some evidence that central bank independence mediates the effect of financial crises on the probability that a central bank governor will be replaced. Above some threshold level of independence, the effect of a financial (banking) crisis on the probability that the central bank governor will be replaced becomes insignificant. Our main findings are robust when we only consider irregular central bank governor turnovers, i.e. replacements before the term in office of the governor has ended. Banking and debt crises have a significant effect on the probability of an irregular replacement of a central bank governor, particularly in developing countries.

Finally, we analyze whether, after a financial crisis, a new central bank governor is more likely to come from the ranks of the executive branch of the government (government ally) or not (non-government ally). Using the data from Vuletin and Zhu (2011) for a much smaller sample than in the rest of the chapter, we find that financial crises increase the probability that a non-government ally will be chosen as a central bank governor. Decomposing financial crises into bank crises, debt crises, and currency crises, we find that only banking crises significantly affect the probability that a non-government ally will be appointed as a central bank governor.

Chapter 5

Do Fiscal Deficits and Debt Crises Cause Inflation in Developing Countries?

5.1 Introduction

Several studies have examined the effect of fiscal deficits on inflation. Sargent and Wallace (1981) argue that under fiscal dominance and a limited absorptive capacity of financial markets, persistent fiscal deficits lead to inflation. However, empirical studies yield mixed results on the effect of fiscal deficits on inflation. Some studies report a non-significant effect of fiscal deficits on money growth both in industrialized countries (Protopapadakis and Siegel, 1987; Barnhart and Darrat, 1988) and in developing countries (De Haan and Zelhorst, 1990; Zoli, 2005). Several studies, such as De Haan and Zelhorst (1990), Hondroyiannis and Papapetrou (1994), Metin (1998), Fischer et al. (2002), and Loungani and Swagel (2003), report only a significant effect of fiscal deficits on inflation in high-inflation countries. Also a more recent study by Catão and Terrones (2005) finds only a significant effect of fiscal deficits on inflation in high-inflation countries. So previous studies suggest that the effect of budget deficits on inflation is not uniform across countries.

A related issue that has received less attention in the literature is the effect of debt crises on inflation. Reinhart and Rogoff (2008) document that since World War II, inflation and debt default have gone hand-in-hand. Hence, it is interesting to examine not only the effect of fiscal deficits on inflation but also the effect of debt crises on inflation. Davig et al. (2011) and Davig and Leeper (2011) explain that if the economy faces a 'fiscal limit', i.e. a point beyond which tax collections can no longer rise and government expenditures cannot be further reduced, an unsustainable debt path will lead to inflation. It occurs when households expect that in the future monetary policy will shift from targeting inflation to stabilizing debt.

This chapter aims to explore the effect of fiscal deficits and debt crises on inflation in developing countries taking dynamics and parameter heterogeneity into account. The main reason to focus on developing countries is that the likelihood of monetary financing is higher in developing countries than in advanced countries. First, developing countries often have limited access to foreign debt, lack a well-developed domestic capital market, and have a limited tax capacity. Second, in several developing countries the central banks are still largely controlled by the government, which makes a fiscal dominance regime (Sargent and Wallace, 19981) more likely. Third, according to data provided by Laeven and Valencia (2008), all debt crises during the years 1970 – 2007 occurred in developing countries.

Most pooled estimators (like fixed and random effects, IV or GMM) presume that the data is suitable to be pooled. However, in panel models with large N and T the assumption of homogeneity of the slope coefficients is quite often rejected. Estimators that impose cross-country constraints dominate heterogeneous estimators in terms of efficiency if the restrictions are valid. If they are false, however, the restricted estimators are inconsistent. In particular, imposing invalid parameter homogeneity in dynamic models typically leads to downward-biased estimates of the speed of adjustment (Pesaran and Smith, 1995). We therefore employ the mean group (MG) and pooled mean group (PMG) estimators (see also Catão and Terrones, 2005, and Klomp and De Haan, 2011). Both methods can capture dynamics and parameter heterogeneity (Pesaran et al., 1999). The MG estimator assumes that the short-run and the long-run coefficients are different

across countries, whereas the PMG estimator allows the intercepts, the short-run coefficients, and the error variance to differ across countries, but in the long run the coefficients are restricted to be the same.

The paper that comes closest to ours is Catão and Terrones (2005).[24] These authors also apply the MG and PMG estimators for a sample covering 107 countries over the period 1960–2001. However, they do not take the effect of debt crises on inflation into account. Moreover, we add more explanatory variables which previous studies suggest to be related to inflation such as political instability (Aisen and Veiga, 2008), food production (Domaç and Yücel, 2005), government ideology (Alesina and Sachs, 1988) and the level of financial development (Sargent and Wallace, 1981). We also examine whether the long-run effect of fiscal deficits and debt crisis on inflation is conditional on inflation, financial development, government ideology, and political instability by including interaction terms in the estimations.

Our sample contains data for 46 developing countries over the period 1975-2007. The sample size is determined by the availability of data on debt crises drawn from Laeven and Valencia (2008). We find that the effect of fiscal deficits and debt crises on inflation is homogenous across countries; both fiscal deficits and debt crises have a positive and significant effect on inflation. Their effects are stronger when inflation increases. Likewise, the impact of debt crises on inflation is stronger in countries that are politically unstable.

The remainder of the paper is structured as follows. Section 5.2 discusses previous studies, while section 5.3 describes the methodology and the data used. Section 5.4 presents the estimation results and the final section offers some concluding comments.

[24] Another related study is Aghion et al. (2000). These authors examine the optimal monetary policy response to a financial crisis, specifically a currency crisis, but do not consider debt crises.

5.2 Literature review

Sargent and Wallace (1981) assume a monetarist economy in which the monetary base is closely related to the price level, and the monetary authority can raise seignorage, i.e. revenue from money creation. When fiscal policy dominates monetary policy, i.e. a regime of fiscal dominance, the fiscal authority independently sets its budget, announcing all current and future deficits, and thus determining the amount of revenue that must be raised through bond sales and seignorage. In this condition, monetary policy is forced to finance fiscal deficits by money creation once the public is no longer willing or able to absorb more government debt. When the fiscal authority continuously runs deficits and the absorptive capacity for government bonds is limited, fiscal deficits will lead to higher money growth and inflation. Catão and Terrones (2005) note that in this type of models the deficit-inflation relationship is dynamic since governments allocate seigniorage intertemporally by borrowing.

Apart from the inflationary effects due to monetary financing of fiscal deficits, some other arguments have suggested as to why deficits may be inflationary. First, the fiscal theory of the price level (FTPL) posits that fiscal deficits have a direct effect on the price level. When the government adjusts the present value of future budget surpluses, the price level will increase to lower the real value of debt (see Leeper 1991; Woodford, 1995). In addition, Elmendorf and Mankiw (1999) argue that fiscal deficits may have an effect on inflation through the wealth effect of government debt that leads to an increase in the demand for goods and services, which in turn may trigger inflation.

Empirical studies about the impact of fiscal deficits on money growth and inflation yield rather mixed results. Some studies, like Levy (1981), McMillin and Beard (1982), and Hoffman and Hubert (1983), which use data for the US, report a strong and positive relationship between fiscal deficits and money growth. Moreover, Domaç and Yücel (2005) find that lax fiscal policy increases the probability of inflation in emerging market economies. On the other hand, Protopapadakis and Siegel (1987), who examine the effect of debt on money and inflation for 10 major advanced countries, do not find a strong relationship between debt growth and inflation. In addition, Barnhart

and Darrat (1988) and Giannoros and Koulluri (1986), who also use data for advanced countries, conclude that there is no significant relationship between fiscal deficits and inflation.

Several studies explore the effect of fiscal deficits on inflation by considering parameter heterogeneity across countries. De Haan and Zelhorst (1990) find that fiscal deficits do not affect inflation in 17 developing countries except during high inflation periods. Likewise, Fischer et al. (2002) find only a significant and positive effect of fiscal deficits on inflation in high-inflation countries and high-inflation periods. In addition, Catão and Terrones (2005) find that fiscal deficits only affect inflation in high-inflation countries, using a sample of 107 countries over the period 1960-2001. The most recent study that we are aware of by Kwon et al. (2009) shows that debt growth is inflationary in highly indebted developing countries.

To the best of our knowledge, there is no study which explicitly examines the effect of debt crises on inflation empirically. Following Laeven and Valencia (2008), a debt crisis is identified by sovereign debt default and restructuring. Reinhart and Rogoff (2008) show that debt crises often come with inflation crises. In addition, several recent theoretical papers, like Davig et al. (2011) and Davig and Leeper (2011), explore the relationship between government debt crises and inflation. According to these authors, every economy faces a time-varying "fiscal limit" that depends on a country's economic and political arrangements and shocks that hit the economy. If government debt is unsustainable, it will lead to inflation in the long run.

5.3 Model and data

5.3.1 Mean Group (MG) and Pooled Mean Group (PMG) estimators

As already mentioned in the previous section, the relationship between fiscal deficits and inflation is dynamic. Moreover, it is likely that there is parameter heterogeneity across countries. Neglecting parameter heterogeneity may lead to inconsistent estimates and potentially misleading inference even for panels with large N and T (see Pesaran and Smith, 1995; Pesaran et al., 1999). Hence, to capture dynamics and parameter

heterogeneity, an auto-regressive distributed lag (ARDL) model will be estimated. The ARDL(p,q) is represented by the following equation:

$$\inf_{i,t} = \mu_i + \sum_{j=1}^{p} \lambda_{i,j} \inf_{i,t-j} + \sum_{l=0}^{q} \delta_{i,l}' z_{i,t-l} + \varepsilon_{i,t} \qquad (5.1)$$

Where $\inf_{i,t}$ is the inflation rate of country *i* at time *t*; μ_i denotes the fixed effects; and $z_{i,t}$ is a (*k* x 1) vector of explanatory variables including the budget balance, our proxy for debt crises, and control variables such as oil price, exchange rate regime, openness, food production, government ideology, political instability, and financial development; $\lambda_{i,j}$ is a vector for the coefficients of lagged inflation; $\delta_{i,l}$ are the coefficients of the explanatory variables. All right-hand side variables enter the equation with a lag to mitigate a potential endogeneity bias.

Equation (5.1) can be re-parameterized as follows:

$$\Delta \inf_{i,t} = \phi_i \inf_{i,t-1} + \beta_i' z_{i,t} + \sum_{j=1}^{p-1} \lambda_{i,j}^* \Delta \inf_{i,t-j} + \sum_{l=0}^{q-1} \delta_{i,j}^{*'} \Delta z_{i,t-l} + \mu_i + \varepsilon_{i,t} \qquad (5.2)$$

i= 1,2,…,N and *t* = 1,2,…,T.

Where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{i,j})$, $\beta_i = \sum_{j=0}^{q} \delta_{i,j}$, $\lambda_{i,j}^* = -\sum_{m=j+1}^{p} \lambda_{i,m}$, $\delta_{i,l}^* = -\sum_{m=l+1}^{q} \delta_{i,m}'$, with *j*= 1,2…, p-1 and l= 1,2,..., q-1.

To find the long-run relationship between the explanatory variables and inflation, equation (5.2) can be written as follows:

$$\Delta \inf_{i,t} = \mu_i + \phi_i [\inf_{i,t-1} - \theta'_i z_{i,t}] + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta \inf_{i,t-j} + \sum_{l=0}^{q-1} \delta_{i,l}^{*'} \Delta z_{i,t-l} + \varepsilon_{i,t} \qquad (5.3)$$

The long-run impact of the fiscal balance, debt crises, and the other explanatory variables on inflation is represented by $\theta_i = -\beta_i / \phi_i$. The error-correcting speed of

adjustment term of inflation towards its equilibrium following a given change in explanatory variables is denoted by ϕ_i, which captures the dynamics.

As shown by Pesaran et al. (1999), two approaches can be applied to estimate equation (5.3). The first method is mean group (MG) estimation, which estimates equation (5.3) for each country separately and assumes that the intercepts, slope coefficients, and error variance differ across countries. Therefore, the common coefficients ϕ and θ are produced by averaging each country's coefficients ϕ_i and θ_i. The MG assumes that the short-run and the long-run effect of fiscal deficits and debt crises on inflation are heterogenous across countries. However, when the heterogeneity of the long-run coefficient θ is violated, MG will produce inefficient estimation.

The second method, the Pool Mean Group (PMG) estimation, combines pooling and averaging. PMG allows the intercept, short-run coefficients, and error variances to differ across countries. However, under PMG the long-run coefficients θ_i are constrained to be the same across individual countries. The PMG estimates will be consistent and efficient when the long-run homogeneity restriction holds. This homogeneity can be tested for using a Hausman test with the null hypothesis that the long-run coefficients are homogenous. As the parameters in equation (5.3) are non-linear, the maximum likelihood method is used to estimate the parameters.

In addition to the control variables used by Catão and Terrones (2005), such as oil price, the exchange rate regime, and openness, food production is included to capture the effect of supply shocks on inflation. The inclusion of food production is important because food has a relatively large share in the consumer price index (CPI) in developing countries. Domaç and Yücel (2005) find that the increase of food production reduces inflation. We also add political instability, as this variable has been found to have a significant effect on inflation (see, for instance, Aisen and Veiga, 2008). Also the ideological position of the party in government is included as an explanatory variable. Left wing parties tend to be less averse to inflation than right wing parties (see Alesina and Sachs, 1988). Finally, the level of financial development is also considered as explanatory variable. Based on Sargent and Wallace (1981), it is expected that in

countries with well-developed financial market the likelihood of monetary financing of fiscal deficits is lower.

The oil price is expected to have a positive effect on inflation through supply-side shocks (see Catão and Terrones, 2005). Countries that have agreed to peg their currencies, especially when those agreements involve many countries, may face political costs of excessive inflation (Campillo and Miron, 1997). Therefore, countries with a fixed exchange rate system are expected to have lower inflation than those with a flexible exchange rate system. Romer (1993) argues that in a more open economy, the time-inconsistency problem of monetary policy will be less than in a closed economy and that therefore inflation will be lower.

We also include interaction terms in equation (5.3) to examine whether the effect of fiscal deficits and debt crises on inflation is conditional on the level of inflation, financial development, government ideology, and political instability. Fiscal deficits and debt crises are expected to have a significant and positive effect on inflation in the long run. However, the effect of both variables on inflation may be different depending on the level of inflation, financial development, government ideology, and political instability. Some previous studies, like Fischer et al. (2002) and Catão and Terrones (2005), suggest that fiscal deficits have a larger effect on inflation in high-inflation countries. In addition, based on Sargent and Wallace (1981), the effect of fiscal deficits on inflation is expected to depend on the level of financial development. Countries with a well-developed financial system have a high absorptive capacity for government bonds so that fiscal deficits and debt crises are arguably less inflationary. Likewise, the impact of budget deficits on inflation may be conditioned by the ideological position of the party in government and the level of political instability.

5.3.2 Data

We use data for 46 developing countries over the period 1975-2007 for which data on debt crisis is available (see Table D.1 in the Appendix for the list of countries included). Data on debt crises come from Laeven and Valencia (2008). Data on governments' fiscal

balance are drawn from the IMF's International Financial Statistics (IFS). The first panel in Table 5.1 presents summary statistics for the variables used in our analysis. Inflation is measured by the percentage change of CPI. Data on inflation come from the World Bank's World Development Indicators (WDI) and IFS. Following Catão and Terrones (2005), the inflation rate is transformed by the formula log(1+inflation) to reduce the influence of extreme observations. There are two groups of countries based on their performance of inflation: high-inflation countries consist of those in the upper quartile of the inflation distribution (with average inflation higher than 18%); and medium-low inflation countries with average inflation lower than 18 percent).

Openness is measured by the share of export plus import in GDP. The data are provided by the WDI. On average, the degree of economic openness in developing countries is relatively high (63%). Table 5.1 shows that openness tends to increase over time. The medium and low inflation countries are more open than the high inflation countries. Moreover, countries that have well-developed financial markets are more open than countries with less developed financial markets.

Financial development is represented by the ratio between M2 and GDP. M2 comprises the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The data come from IFS and WDI. The sample is split in two with respect to financial development as well: countries with a low level of financial development (with average M2/GDP less than 36%) and countries with a high level of financial development (with average M2/GDP higher than 36%). For the fill sample, the ratio of M2 to GDP tends to increase over time.

The dummy variable left government comes from updates of Beck et al. (2001); it is 1 if the main party in government is a left wing party, otherwise it is zero.

The oil price is measured by the product of WTI (West Texas Intermediate) Spot Price of crude oil in dollars and the exchange rate of domestic currency to US dollar.[25] For the estimation, we take the percentage change of the oil price. The oil price can be

[25] The data can be downloaded at: http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm.

used as the proxy of supply side inflation. Another supply side driver of inflation is the percentage change of food production that comes from WDI.

The exchange rate regime is proxied by the Reinhart and Rogoff (2004) index which ranges from 1 to 6. A higher score of the index indicates that the country has a more flexible exchange rate regime. Table 5.1 shows that high inflation countries have a more flexible exchange rate regime than medium and low inflation countries.

Finally, following Dreher et al. (2010) political instability is proxied by the first principal component of a number of regime instability indicators from Databanks International (2010): revolutions, purges, riots, strikes, assassinations, guerilla warfare, major crises, and the number of (successful) coups d'états. A higher value of this variable indicates that the political situation is less stable. Countries that have political instability score above the average are categorized as unstable, while the other countries are categorized as stable.

Table 5.1 Summary Statistics

	Inflation	Deficits	Debt Crisis	Openness	M2/GDP	Oil Prices	Exchange Rate Regime	Political Instability	Food Production
All Countries									
1975-1985	0.527	-0.047	0.047	0.554	0.306	0.679	2.476	0.014	0.029
1986-1996	1.361	-0.026	0.004	0.607	0.346	1.098	2.798	0.124	0.031
1997-2007	0.089	-0.021	0.008	0.711	0.419	0.221	2.330	-0.138	0.029
High Inflation Countries									
1975-1985	1.320	-0.050	0.080	0.388	0.282	1.456	3.492	0.123	0.026
1986-1996	3.567	-0.027	0.005	0.438	0.267	2.821	3.690	0.109	0.033
1997-2007	0.123	-0.018	0.011	0.517	0.280	0.269	2.797	0.050	0.033
Medium-Low Inflation Countries									
1975-1985	0.106	-0.046	0.028	0.646	0.320	0.224	1.881	-0.051	0.032
1986-1996	0.109	-0.026	0.003	0.705	0.392	0.094	2.276	0.132	0.030
1997-2007	0.069	-0.023	0.006	0.824	0.500	0.192	2.056	-0.250	0.027
Well Developed Financial Market									
1975-1985	0.152	-0.062	0.038	0.651	0.385	0.284	2.043	0.060	0.032
1986-1996	1.473	-0.029	0.010	0.728	0.488	0.883	2.344	0.052	0.037
1997-2007	0.060	-0.024	0.005	0.868	0.631	0.193	2.086	-0.336	0.028
Less Developed Financial Market									
1975-1985	0.807	-0.036	0.054	0.483	0.249	0.958	2.781	-0.024	0.028
1986-1996	1.280	-0.024	0.000	0.522	0.246	1.249	3.118	0.183	0.027
1997-2007	0.109	-0.019	0.010	0.600	0.269	0.240	2.502	0.024	0.030
Left Wing Government									
1975-1985	1.451	-0.074	0.063	0.537	0.329	1.747	2.759	-0.045	0.023
1986-1996	3.646	-0.042	0.000	0.534	0.340	2.554	3.151	0.128	0.031
1997-2007	0.111	-0.016	0.020	0.587	0.350	0.191	2.590	-0.259	0.026
Non Left Wing Government									
1975-1985	0.277	-0.039	0.043	0.546	0.312	0.411	2.341	0.034	0.031
1986-1996	0.830	-0.022	0.006	0.615	0.366	0.801	2.734	0.122	0.033
1997-2007	0.078	-0.020	0.006	0.747	0.464	0.228	2.279	-0.102	0.030
Politically Unstable									
1975-1985	1.328	-0.055	0.064	0.443	0.292	1.577	2.816	1.204	0.030
1986-1996	2.711	-0.033	0.006	0.508	0.328	2.095	2.939	1.028	0.024
1997-2007	0.114	-0.030	0.018	0.575	0.380	0.239	2.540	1.042	0.025
Politically Stable									
1975-1985	0.214	-0.044	0.041	0.598	0.311	0.333	2.345	-0.547	0.029
1986-1996	0.594	-0.023	0.003	0.663	0.356	0.547	2.720	-0.509	0.035
1997-2007	0.081	-0.018	0.005	0.750	0.430	0.215	2.270	-0.545	0.031

5.4 Estimation results

In this section we examine the effect of fiscal deficit and debt crises on inflation controlling for the variables outlined in the previous section. We present the estimation results of equation (5.3) by employing MG and PMG estimates for 46 developing countries during the period 1975-2007. In addition, we include the interaction terms of fiscal deficits and debt crises with the level of inflation, financial development, the ideological position of the government, and political instability.

The Schwartz Bayesian criterion (SBC) is employed to choose the optimal number of lags for each variable for each country regression. Based on SBC, the ARDL with p=1 and q=1 is preferred for almost all of countries. Next, the Hausman test is used to test for the long-run homogeneity of the coefficients of all explanatory variables. The null of the Hausman test is that the long-run coefficients are homogeneous. If the Hausman test indicates that the null hypothesis is rejected, it means that the MG estimator is preferred to the PMG estimator. The MG assumes that the effect of fiscal deficits and debt crises on inflation is heterogenous across countries both in the short and long run. On the other hand, if the null cannot be rejected the PMG estimator is preferred. It means that the long-run effect of fiscal deficits and debt crises on inflation is homogenous across countries.

In columns (1) of Table 5.2, we start by the model using the control variables suggested by Catão and Terrones (2005). The h-statistic cannot reject the homogeneity of the long-run coefficients at the 5 significance percent level so that the PMG estimator is preferred. According to the PMG estimates, the coefficient of the fiscal balance is negative indicating that a higher fiscal surplus (deficit) leads to lower (higher) inflation in the long run. Meanwhile, the proxy for debt crises has a positive sign indicating that a debt crisis increases inflation in the long run. The oil price also has a statistically significant impact on inflation. In contrast, the coefficient of openness is not statistically significant. Since the openness variable is not statistically significant, we delete this variable in column (2). The exchange rate regime has a significant and positive effect on inflation, i.e. countries with a more flexible exchange rate have higher inflation.

In the next columns, we include the other control variables such as food production, political instability, left wing government, and financial development. When we include food production in the model, the Hausman test shows that the PMG estimator is still preferred. In this model, the coefficient of food production is significant with a negative sign, indicating that higher food production leads to lower inflation (column (3) of Table 5.2).

When we include both food production and political instability into the model, it turns out that also political instability has a significant and positive effect on inflation indicating that the countries with more unstable political regimes tend to have higher inflation. Finally, when we include the other control variables, i.e. left wing government and financial development, all other variables, including the fiscal balance and debt crises, remain significant. Whereas the partisan variable is not significant, financial development turns out to be significant with a negative sign (column 6).

The estimated error correction (EC) coefficient is less than 0.5 which implies that the adjustment of inflation to a given change in fiscal balance and the occurrence of a debt crisis have an average half-life of just over one year.

In conclusion, we find that fiscal deficits and debt crises are increasing inflation in the long run. The long-run effect of these variables on inflation is homogenous across countries. Other variables that have a significant effect on inflation are oil price inflation, the exchange rate regime, food production, political instability, and the level of financial development.

Table 5.2 PMG Estimation Results of Equation (5.3)
(Dependent Variable: Inflation; Using Fiscal Balance as Share of GDP as Explanatory Variable)

	(1)	(2)	(3)	(4)	(5)	(6)
Long-run coefficients						
Fiscal Balance/GDP	-0.251***	-0.217***	-0.217***	-0.227***	-0.228***	-0.179***
	(0.035)	(0.030)	(0.029)	(0.031)	(0.030)	(0.031)
Debt Crisis	0.059***	0.034***	0.027**	0.057***	0.063***	0.065***
	(0.014)	(0.012)	(0.012)	(0.014)	(0.016)	(0.014)
Oil Price Inflation	0.049***	0.053***	0.055***	0.0533***	0.055***	0.055***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Trade Openness	-0.007					
	(0.007)					
Exchange rate regime	0.018***	0.018***	0.018***	0.019***	0.018***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Food Production			-0.070***	-0.055***	-0.059***	-0.056***
			(0.018)	(0.019)	(0.020)	(0.017)
Political Instability				0.008***	0.008***	0.006***
				(0.002)	(0.002)	(0.002)
Dummy Left					0.000	0.000
					(0.001)	(0.001)
M2/GDP						-0.025***
						(0.007)
EC coefficient	-0.395***	-0.407***	-0.395***	-0.393***	-0.387***	-0.401***
	(0.038)	(0.037)	(0.037)	(0.043)	(0.043)	(0.045)
h-statistic	1.040	1.600	2.11	2.27	3.29	4.77
	[0.959]	[0.808]	[0.834]	[0.893]	[0.857]	[0.782]
No. Observations	1449	1459	1459	1272	1268	1268

Note: *** p<0.01, ** p<0.05, * p<0.1. The standard error is shown in parentheses and the p-value is in brackets. The h-statistic refers to the Hausman test on the long-run homogeneity restriction.

According to the theoretical model of Catão and Terrones (2005), the rate of inflation is proportional to the ratio of the government deficit to the average stock of "narrow" money instead of the deficit to GDP ratio. We therefore replace the fiscal balance to GDP ratio by the fiscal balance to M1 ratio as explanatory variable. The estimations results are presented in Table 5.3.

Based on the Hausman test, the PMG estimator is preferred to the MG estimator. It turns out that the fiscal balance is statistically significant with a negative sign. It means that fiscal deficits lead to inflation. This result is robust when we include all explanatory variables. Moreover, debt crises also significantly increase inflation in the long run.

Next, we examine whether the long-run effect of fiscal deficits and debt crises on inflation is conditional on other variables. Hence, we include interaction terms of the fiscal balance and debt crises variables with inflation, financial development, the presence of a left wing government, and political instability.

Table 5.3 PMG Estimation Results of Equation (5.3) (Dependent Variable: Inflation: Using Fiscal Balance as Share of M1 as Explanatory Variable)

	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
Fiscal Balance/M1	-0.013***	-0.014***	-0.015***	-0.017***	-0.011***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
Debt Crisis	0.037***	0.031**	0.080***	0.093***	0.081***
	(0.013)	(0.013)	(0.015)	(0.017)	(0.014)
Oil Price Inflation	0.057***	0.059***	0.057***	0.061***	0.060***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Exchange rate regime	0.019***	0.019***	0.020***	0.018***	0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Food Production		-0.079***	-0.058**	-0.064***	-0.066***
		(0.021)	(0.024)	(0.024)	(0.019)
Political Instability			0.008***	0.009***	0.006***
			(0.002)	(0.002)	(0.002)
Dummy Left				0.001	0.000
				(0.001)	(0.001)
M2/GDP					-0.032***
					(0.007)
EC coefficient	-0.399***	-0.388***	-0.380***	-0.370***	-0.392***
	(0.036)	(0.036)	(0.041)	(0.042)	(0.044)
h-statistic	[0.930]	[2.180]	[2.980]	[2.410]	[2.470]
	0.921	0.824	0.811	0.934	0.963
No. Observations	1459	1459	1272	1268	1268

Note: *** p<0.01, ** p<0.05, * p<0.1. The standard error is shown in parentheses and the p-value is in brackets. The h-statistic refers to the Hausman test on the long-run homogeneity restriction.

Column (1) of Table 5.4 repeats the PMG estimates of Table 5.2 including all explanatory variables. Next, in column (2) we include the interaction term between fiscal balance and inflation. The interaction term is statistically significant with a negative sign. Table 5.5 shows the total marginal effect of the fiscal balance on inflation between

interquantile ranges of inflation. It is clear that the impact of a fiscal deficit on inflation becomes stronger when the level of inflation increases. This result is in line with the findings of previous studies, like Fischer et al. (2002).

In column (3) of Table 5.4 we include the interaction terms between debt crises and inflation. The interaction term is statistically significant with a positive sign. The marginal effect of debt crises conditional on inflation as shown in Table 5.5 suggests that the effect of debt crises on inflation become stronger when inflation increases.

When we include the interaction terms of the fiscal balance and debt crises with financial development and the dummy reflecting the presence of a left wing government, the interaction terms are not statistically significant (see columns (4)-(7) of Table 5.4). Finally, the interaction term of debt crises and political instability is statistically significant (column 9). The effect of debt crises on inflation becomes stronger when political instability increases (see Table 5.5 for the marginal effect). However, the interaction term of fiscal balance and political instability (shown in column (8) of Table 5.4) is not statistically significant.

Table 5.4 Estimation Results of Equation (5.3) with Interaction Terms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Long-run coefficients									
Fiscal Balance/GDP	-0.179***	0.211***	-0.186***	-0.060	-0.174***	-0.178***	-0.179***	-0.163***	-0.166***
	(0.031)	(0.047)	(0.031)	(0.066)	(0.031)	(0.032)	(0.031)	(0.036)	(0.030)
Debt Crisis	0.065***	0.092***	0.008	0.070***	0.101***	0.067***	0.065***	0.070***	0.040***
	(0.014)	(0.015)	(0.025)	(0.014)	(0.024)	(0.014)	(0.014)	(0.014)	(0.015)
Oil Price Inflation	0.055***	0.037***	0.052***	0.058***	0.055***	0.056***	0.055***	0.055***	0.055***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Exchange rate regime	0.014***	0.015***	0.015***	0.015***	0.015***	0.015***	0.014***	0.013***	0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Food Production	-0.056***	-0.047**	-0.052***	-0.057***	-0.059***	-0.062***	-0.056***	-0.050***	-0.056***
	(0.017)	(0.020)	(0.017)	(0.018)	(0.017)	(0.018)	(0.017)	(0.018)	(0.017)
Political Instability	0.006***	0.007***	0.006***	0.007***	0.006***	0.006***	0.006***	0.007**	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Dummy Left	0.000	0.000	-0.001	0.0001939	0.000	-0.001	-0.0004835	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
M2/GDP	-0.025***	-0.004	-0.025***	-0.028***	-0.024***	-0.025***	-0.025***	-0.025***	-0.025***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Fiscal Balance x inflation		-7.526***							
		(0.619)							
Debt Crisis x inflation			0.686**						
			(0.308)						

Fiscal Balance x M2/GDP				-0.232					
				(0.128)					
Debt Crisis x M2/GDP					-0.048				
					(0.032)				
Fiscal Balance x Dummy Left						-0.018			
						(0.055)			
Debt Crisis x Dummy Left							0.001		
							(0.051)		
Fiscal Balance x Political Instability								0.020	
								(0.049)	
Debt Crisis x Political Instability									0.088***
									(0.025)
EC coefficient	-0.401***	-0.301***	-0.410***	-0.391***	-0.399***	-0.396***	-0.401***	-0.393***	-0.403***
	(0.045)	(0.037)	(0.046)	(0.044)	(0.045)	(0.046)	(0.045)	(0.045)	(0.050)
h-statistic	4.770	12.930		3.700	5.670	3.8	4.82	4.900	4.16
	[0.782]	[0.166]		[0.930]	[0.773]	[0.924]	[0.777]	[0.843]	[0.901]
No. Observations	1268	1268	1268	1268	1268	1268	1268	1268	1268

Note: *** p<0.01, ** p<0.05, * p<0.1. The standard error is shown in parentheses and the p-value is in brackets. The h-statistic refers to the Hausman test on the long-run homogeneity restriction.

Table 5.5 Marginal Effects of Interaction Effects

	Inflation			Political Instability			M2/GDP		
	Q=25	Q=50	Q=75	Q=25	Q=50	Q=75	Q=25	Q=50	Q=75
Fiscal Deficit	0.000	-0.36	-0.768	-0.176	-0.174	-0.164	-0.098	-0.121	-0.143
Debt crisis	0.027	0.06	0.097	-0.019	-0.008	0.035	-0.240	-0.245	-0.249

Note: The numbers in the table represents the marginal effect of fiscal deficits and debt crises on inflation between the three inter-quantile ranges (Q=25, Q=50, and Q=75) of variables inflation, political instability, and M2/GDP. Since the interaction term of fiscal deficits with political instability is not statistically significant, the marginal effect tends to be constant over quantiles. Likewise, the marginal effect of fiscal deficits and debt crises on inflation across quantile ranges of M2/GDP is quite constant.

5.5 Conclusions

This study examines the effect of fiscal deficits and debt crises on inflation in developing countries. To cover dynamics and parameter heterogeneity across countries, the Mean Group (MG) and the Pool Mean Group (PMG) estimators are employed. Based on the estimation results, we conclude that fiscal deficits and debt crises have a significant positive effect on inflation in the long run. These effects are homogenous across countries. The results are robust when we include either fiscal balance as share of GDP or as share of M1—as suggested by Catão and Terrones (2005)—as explanatory variable. We also find that the long run effects of fiscal deficits and debt crises on inflation are conditional on the level of inflation and (for debt crises) on political instability. The higher the rate of inflation, the larger will be the effect of fiscal deficits and debt crises on inflation. Likewise, the effect of a debt crisis on inflation becomes stronger when political instability increases

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Chapter 6

Concluding Remarks and Policy Implications

6.1 General Conclusions

Four research questions have been addressed in this dissertation. **First**, how have the legal and actual independence of Bank Indonesia (BI) developed since its creation to the present time? **Second**, what role does labor market flexibility play when it comes to the impact of the most recent financial crisis on output and unemployment? **Third**, what is the effect of financial crises on the replacement of a central bank governor? **Fourth**, do fiscal deficits and debt crises cause inflation in developing countries?

In order to answer the first question, we proxy the legal and actual independence of Bank Indonesia for the period 1953-2009 by extending the legal CBI index of Cukierman (1992) and expanding the actual CBI index of Cukierman (2007). In constructing the legal index, we add financial independence of central bank to the index of Cukierman (1992). To measure actual independence, we consider institutional and economic factors that affect the independence of Bank Indonesia, such as financial market development, the size of government deficits, the exchange rate regime, and the function of the central bank as a development bank. Moreover, we consider the background of central bank governors, the turnover of governors, and the reasons for their dismissal.

We find that before Bank Indonesia was mandated as an independent institution in 1999, the legal and actual independence of BI diverged substantially. The actual independence of Bank Indonesia is much higher than its legal independence during that period. Several factors, like the background of governors (mostly coming from Bank Indonesia) and the absence of dismissals before the end of the legal term in office, contributed to the divergence of the actual index from the legal index. The improvement of the government's fiscal position, the development of financial markets, and the deregulation of the economy are amongst the factors contributing to a high level of actual independence of Bank Indonesia. After Bank Indonesia was mandated as a legally independent institution by a new central bank law, the legal independence of BI increased significantly, especially the independence in monetary policy formulation and the absence of forced lending to the government. When we estimate the relationship between inflation and CBI in Indonesia, the results suggest that the actual independence has a significant and negative effect on inflation. If actual independence is decomposed into its components, only the component capturing limitations on lending to government comes out significantly.

As to the second question, by employing cross-country regressions we find that countries with low hiring cost suffered lower output losses due to the current financial crisis. However, countries with lower dismissal cost recovered slower than countries with higher dismissal cost. Regulatory trade barriers, openness, credit growth, financial integration, inflation stability, and population growth are also found to have a significant effect on output losses. Fewer restrictions on international trade lead to lower output losses. However, countries depending on trade are more vulnerable to external shocks. Countries that have highly integrated financial markets and experienced rapid credit growth prior to the global crisis were hit hard. Moreover, countries in which the monetary authorities could keep inflation stable and with higher population growth experienced lower output losses. With respect to the speed of recovery from the crisis, we find that apart from labor market flexibility, only trade barriers, credit growth, and exchange rate regimes are statistically significant. When the impact of the crisis on unemployment is

explored, we find that in industrial countries lower hiring cost are related to lower employment losses due to the financial crisis, but the size of the effect is rather small.

To address our third research question, i.e. the effect of financial crises on central bank independence, we consider both regular and irregular replacements of central bank governors as indicators of central bank independence. By employing a conditional fixed effects logit model with clustered robust standard errors, we find that financial crises increase the probability of a central bank governor replacement. When crises are decomposed into banking, currency, and debt crises, the results show that only banking and debt crises significantly increase the likelihood of a central bank governor turnover. The other variables increasing the probability that the central bank governor will be replaced are the share of time in the office elapsed, inflation, and elections, notably in developing countries. There is some evidence that central bank independence mediates the effect of financial crises on the replacement of a central bank governor. Above some threshold level of legal independence, the effect of a financial (banking) crisis on the probability that the central bank governor will be replaced becomes insignificant. Employing the data from Vuletin and Zhu (2011), we find that financial crises (particularly banking crises) increase the likelihood that a non-government ally will be appointed as central bank governor.

Finally, the last paper of this dissertation aims to answer the question: do fiscal deficits and debt crises cause inflation in developing countries? By employing the Mean Group (MG) and the Pooled Mean Group (PMG) estimation methods, we conclude that fiscal deficits and debt crises have a significant positive effect on inflation in the long run. The effects are homogenous in the long run across countries. A higher oil price, a more flexible exchange rate, and more political instability also cause higher inflation. In contrast, a higher food production and more advanced financial development lead to lower inflation. We also find that the long-run effects of fiscal deficits and debt crises on inflation are conditional on the level of inflation and (for debt crises) on political instability. The higher the rate of inflation, the larger will be the effect of fiscal deficits and debt crises on inflation. Likewise, the effect of a debt crisis on inflation becomes stronger when political instability increases.

6.2 Limitations of the Study

This dissertation has some limitations. Firstly, in the study on legal and actual independence of Bank Indonesia, we did not relate the constructed indexes to other macroeconomic variables such as interest rates and financial stability. An independent central bank that is free from political pressure may behave more predictably, promoting economic stability, and reducing risk premia in real interest rates (Alesina and Summers, 1993). Greater independence from external pressure also implies that central banks are less politically constrained in acting to prevent financial distress (Klomp and de Haan, 2008). We leave this for future research. In addition, the proposed method used to construct the legal and actual CBI for Bank Indonesia can be applied to other central banks. Also this would be an interesting issue for future research.

For the second paper on the labor market flexibility and the impact of the financial crisis, we use cross-country regressions. As not all countries were out of the recession at the end of the sample period, the impact of the crisis on output loss and the duration of the crisis are underestimated. Hence, an idea for future research is to capture the movement of output and unemployment during the crisis over time across countries by applying panel data.

The data of financial crises used in the last two papers do not cover the current financial crisis in most developed countries. Particularly for debt crises, during the years 1970-2007, all debt crises occurred in developing countries and not in industrial countries. Therefore, to capture the current financial crisis which hit industrial countries, we can expand the data of financial crises. So far, most studies examining the recent financial crisis are theoretical or descriptive.

6.3 Policy Implications

The findings of this dissertation suggest some policy implications. Based on the first paper, the actual independence of Bank Indonesia diverged from its legal independence

before it was mandated as an independent central bank by the law. The actual independence, particularly limitations on lending to government, significantly affect inflation, in contrast to legal independence. Hence, it implies that besides the reform of the central bank law, actual independence should be given much attention, notably institutional and economic factors which affect central bank independence in practice, such as the size of government deficits and financial market development.

The occurrence of financial crises threatens the independence of central banks. Our results show that financial crises, particularly banking crises and debt crises, increase the probability that a central bank governor will be replaced. This result is in line with evidence that the central bank governors of Argentina and Mexico were dismissed when they did not want to cooperate with their respective governments during the recent financial crisis. The political pressure on a central bank during a financial crisis may limit the central bank's abilities to attain targeted inflation. For instance, several central banks engage in policies that have fiscal dimensions, such as credit easing policies and the purchase of long-term treasury securities. Our findings suggest that unsustainable fiscal policies and debt crises cause inflation in the long run. Therefore, coordination between monetary and fiscal policies in the current financial crisis needs to be transparent so that it is clear that actions by the central bank are consistent with its mandate (Walsh, 2011). Moreover, to reduce the pressure on inflation, fiscal policy has to become sustainable.

Finally, the impact of the current financial crisis on output and unemployment is related to the flexibility of the labor market. Countries with low hiring cost suffered lower output losses and unemployment due to the recent financial crisis. However, countries with lower dismissal cost recovered slower than countries with higher dismissal cost. Our findings imply that there is a trade-off between the depth of the crisis and the duration of the crisis. Hence, when deciding on how flexible labor markets should be, policy makers should take this trade-off into account.

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Appendix

Table A1. The Legal Index of Cukierman (1992) and Our Extended Legal Index

Cukierman Index				The Extended Index			
Variable number	**Description of variable**	**Weight**	**Numerical coding**	**Variable number**	**Description of variable**	**Weight**	**Numerical coding**
1	**Chief executive officer (CEO)**	**0.20**		1	**Chief executive officer (CEO)**	**0.21**	
	Term of office	***0.25***			**Term of office**	***0.25***	
	Over 8 years		1		Over 8 years		1
	6 to 8 years		0.75		6 to 8 years		0.75
	5 years		0.5		5 years		0.5
	4 years		0.25		4 years		0.25
	Under 4 years or at the discretion of appointer		0		Under 4 years or at the discretion of appointer		0
	Who appoints CEO	***0.25***			**Who appoints CEO**	***0.25***	
	Board of central bank		1		Board of central bank		1
	A council of the central bank board, executive		0.75		A council of the central bank board, executive		0.75
	branch, and legislative branch				branch, and legislative branch		
	Legislature		0.5		Legislature		0.5
	Executive collectively (e.g. council of ministers)		0.25		Executive collectively (e.g. council of ministers)		0.25
	One or two members of the executive branch		0		One or two members of the executive branch		0
	Dismissal	***0.25***			**Dismissal**	***0.25***	
	No provision for dismissal		1		No provision for dismissal		1

	Only for reasons not related to policy		0.83	Only for reasons not related to policy		0.83
	At the discretion of central bank board		0.67	At the discretion of central bank board		0.67
	At legislature's discretion		0.5	At legislature's discretion		0.5
	Unconditional dismissal possible by legislature		0.33	Unconditional dismissal possible by legislature		0.33
	At executive's discretion		0.17	At executive's discretion		0.17
	Unconditional dismissal possible by executive		0	Unconditional dismissal possible by executive		0
	May CEO hold other offices in government?	***0.25***		**May CEO hold other offices in government?**	***0.25***	
	No		1	No		1
	Only with permission of the executive branch		0.5	Only with permission of the executive branch		0.5
	No rule against CEO holding another office		0	No rule against CEO holding another office		0
2	**Policy formulation**	**0.15**		2 **Policy formulation**	**0.16**	
	Who formulates monetary policy	***0.25***		**Who formulates monetary policy**	***0.25***	
	Bank alone		1	Bank alone		1
	Bank participates, but has little influence		0.67	Bank participates, but has little influence		0.67
	Bank only advises government		0.33	Bank only advises government		0.33
	Bank has no say		0	Bank has no say		0
	Who has final word in resolution of conflict?	***0.5***		**Who has final word in resolution of conflict?**	***0.5***	
	The bank, on issues clearly defined in the law as its objectives		1	The bank, on issues clearly defined in the law as its objectives		1

		Government, only policy issues not clearly defined as the bank's goals or in case of conflict within bank		0.8		Government, only policy issues not clearly defined as the bank's goals or in case of conflict within bank	0.8
		A council of the central bank, executive branch, and legislative branch		0.6		A council of the central bank, executive branch, and legislative branch	0.6
		The legislature, on policy issues		0.4		The legislature, on policy issues	0.4
		The executive branch on policy issues, subject to due process and possible protest by the bank		0.2		The executive branch on policy issues, subject to due process and possible protest by the bank	0.2
		The executive branch has unconditional priority		0		The executive branch has unconditional priority	0
		Role in the government's budgetary process	***0.25***			**Role in the government's budgetary process**	***0.25***
		Central bank active		1		Central bank active	1
		Central bank has no influence		0		Central bank has no influence	0
3	**Objectives**		**0.15**		3	**Objectives**	**0.05**
	Price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives			1		Price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government Objectives	1
	Price stability is the only objective			0.8		Price stability is the only objective	0.8
	Price stability is one goal, with other compatible objectives, such as a stable banking system			0.6		Price stability is one goal, with other compatible objectives, such as a stable banking system	0.6

	Price stability is one goal, with potentially conflicting objectives, such as full employment		0.4		Price stability is one goal, with potentially conflicting objectives, such as full employment		0.4
	No objectives stated in the bank charter		0.2		No objectives stated in the bank charter		0.2
			0		Stated objectives do not include price stability		0
4	**Limitation on lending to the government**	**0.50**		4	**Limitation on lending to the government**	**0.42**	
	Advances (limitation on non-securitized lending)	***0.3***			**Advances (limitation on non-securitized lending)**	***0.3***	
	No advances permitted		1		No advances permitted		1
	Advances permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67		Advances permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67
	Advances permitted, and the limits are loose (e.g., over 15 % of government revenue)		0.33		Advances permitted, and the limits are loose (e.g., over 15 % of government revenue)		0.33
	No legal limits on lending		0		No legal limits on lending		0
	Securitized lending	***0.2***			**Securitized lending**	***0.2***	
	Not permitted		1		Not permitted		1
	Permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67		Permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67
	Permitted, and the limits are loose (e.g., over 15 % of government revenue)		0.33		Permitted, and the limits are loose (e.g., over 15 % of government revenue)		0.33
	No legal limits on lending		0		No legal limits on lending		0
	Terms of lending (maturity, interest, amount)	***0.2***			**Terms of lending (maturity, interest, amount)**	***0.2***	

Controlled by the bank		1	Controlled by the bank		1
Specified by the bank charter		0.67	Specified by the bank charter		0.67
Agreed between the central bank and executive		0.33	Agreed between the central bank and executive		0.33
Decided by the executive branch alone		0	Decided by the executive branch alone		0
Potential borrowers from the bank	***0.1***		**Potential borrowers from the bank**	***0.1***	
Only the central government		1	Only the central government		1
All levels of government (state as well as central)		0.67	All levels of government (state as well as central)		0.67
Those mentioned above and public enterprises		0.33	Those mentioned above and public enterprises		0.33
Public and private sector		0	Public and private sector		0
Limits on central bank lending defined in	***0.05***		**Limits on central bank lending defined in**	***0.05***	
Currency amounts		1	Currency amounts		1
Shares of central bank demand liabilities or capital		0.67	Shares of central bank demand liabilities or capital		0.67
Shares of government revenue		0.33	Shares of government revenue		0.33
Share of government expenditures		0	Share of government expenditures		0
Maturity of loans	***0.05***		**Maturity of loans**	***0.05***	
Within 6 months		1	Within 6 months		1
Within 1 year		0.67	Within 1 year		0.67
More than 1 year		0.33	More than 1 year		0.33
No mention of maturity in the law		0	No mention of maturity in the law		0
Interest rates on loans must be	***0.05***		**Interest rates on loans must be**	***0.05***	

	Above minimum rates	1		Above minimum rates	1
	At market rates	0.75		At market rates	0.75
	Below maximum rates	0.5		Below maximum rates	0.5
	Interest rate is not mentioned	0.25		Interest rate is not mentioned	0.25
	No interest on government borrowing from the central bank	0		No interest on government borrowing from the Central bank	0
	Central bank prohibited from buying or selling Government securities in the primary market?	***0.05***		**Central bank prohibited from buying or selling Government securities in the primary market?**	***0.05***
	Yes	1		Yes	1
	No	0		No	0
			5	**Financial Independence**	**0.16**
				Determination of the central bank's budget	***0.33***
				Mostly central bank	1
				Mixture of bank and executive or legislative branches	0.5
				Mostly executive or legislative branches	0
				Determination of the allocation of bank profits	***0.33***
				Mostly by bank or fixed by law	1
				Mixture of bank and executive or legislative branches	0.5
				Mostly executive or legislative branches	0

Who is responsible for central bank losses	***0.33***	
Central Bank is fully responsible		1
At certain capital limit, government should capitalize the central bank		0.5
Government		0

Table A.2. The Index of Legal Independence vs. the Index of Actual Independence

Legal Index				Actual Index			
Variable number	**Description of variable**	**Weight**	**Numerical coding**	**Variable number**	**Description of variable**	**Weight**	**Numerical coding**
1	**Chief executive officer (CEO)**	**0.21**		**1**	**Chief executive officer (CEO)**	**0.21**	
	Term of office	***0.25***			**Overlap with Government's change**	***0.25***	
	Over 8 years		1		10 months or more		1
	6 to 8 years		0.75		7-9 months		0.75
	5 years		0.5		4-6 months		0.5
	4 years		0.25		2-3 months		0.25
	Under 4 years or at the discretion of appointer		0		0-1 month		0
	Who appoints CEO	***0.25***			**Background of CEO**	***0.25***	
	Board of central bank		1		Independent expert		1
	A council of the central bank board, executive		0.75		Central bank staff		0.75
	branch, and legislative branch				Mix between ex- government and central bank staff		0.5
	Legislature		0.5		Government staff		0.25
	Executive collectively (e.g. council of ministers)		0.25		Politician		0
	One or two members of the executive branch		0				
	Dismissal	***0.25***			**Dismissal**	***0.25***	

		No provision for dismissal		1		No dismissal	1
		Only for reasons not related to policy		0.83		Resignation and permanently prevented	0.83
		At the discretion of central bank board		0.67		Poor performance (for instance inflation target is not attained)	0.67
		At legislature's discretion		0.5		Crime and corruption	0.5
		Unconditional dismissal possible by legislature		0.33		Related to policy causing central bank loss	0.33
		At executive's discretion		0.17		Political participation	0.17
		Unconditional dismissal possible by executive		0		Without a clear reason	0
		May CEO hold other offices in government?	***0.25***			**CEO holds other office?**	***0.25***
		No		1		No other position	1
		Only with permission of the executive branch		0.5		Private sector position	0.5
		No rule against CEO holding another office		0		Government &Political Position	0
2	**Policy formulation**		**0.16**		**2**	**Policy formulation**	**0.16**
		Who formulates monetary policy	***0.25***			**Exchange rate regime & capital mobility**	***0.25***
		Bank alone		1		Fixed exchange rate, perfect capital mobility	1
		Bank participates, but has little influence		0.67		Fixed exchange rate, imperfect capital mobility	0.67
		Bank only advises government		0.33		Flexible exchange rate, imperfect capital mobility	0.33
		Bank has no say		0		Flexible exchange rate, perfect capital mobility	0
		Who has final word in resolution of conflict?	***0.5***			**Banking supervision and sources of funding for bank failure**	***0.5***
		The bank, on issues clearly defined in the law as		1		Central bank not as banking supervision and not responsible for the cost of bank failure	1

		its objectives				Central bank as a bank supervision and government/independent institution is responsible for the cost of bank failure	0.5
		Government, only policy issues not clearly defined as the bank's goals or in case of conflict within bank		0.8		Central bank as a bank supervision and responsible for the cost of bank failure	0
		A council of the central bank, executive branch, and legislative branch		0.6			
		The legislature, on policy issues		0.4			
		The executive branch on policy issues, subject to due process and possible protest by the bank		0.2			
		The executive branch has unconditional priority		0			
		Role in the government's budgetary process	***0.25***			**Decision on the target of exchange rate and inflation for government's budget**	***0.25***
		Central bank active		1		Independently by central bank	1
		Central bank has no influence		0		Jointly with government	0.5
						By government only	0
3	**Objectives**		**0.05**		**3**	**Objectives**	**0.05**
		Price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government		1		Function as a development bank, granting credit at subsidy rates?	
						No	1
						To some extent	0.66

	objectives			Yes		0.33
	Price stability is the only objective		0.8	The central bank heavily involved in granting subsidized credits		0
	Price stability is one goal, with other compatible objectives, such as a stable banking system		0.6			
	Price stability is one goal, with potentially conflicting objectives, such as full employment		0.4			
	No objectives stated in the bank charter		0.2			
	Stated objectives do not include price stability		0			
4	**Limitation on lending to the government**	**0.42**		**4 Limitation on lending to the government**	**0.5**	
	Advances (limitation on non-securitized lending)	***0.3***		**Actual deficits (surplus)/GDP**	***0.3***	
	No advances permitted		1	Surplus		1
	Advances permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67	0<deficits=<3%		0.67
				3%<deficits=<6%		0.33
	Advances permitted, and the limits are loose (e.g., over 15 % of government revenue)		0.33	Deficits>6%		0
	No legal limits on lending		0			
	Securitized lending	***0.2***		**Financial market development (M2/GDP)**	***0.2***	
	Not permitted		1	M2/GDP>52%		1
	Permitted, but with strict limit (e.g., up to 15 % of government revenue)		0.67	52%>=M2/GDP>32%		0.75
				32%>=M2/GDP>20%		0.5

Permitted, and the limits are loose (e.g., over 15		0.33	20%>=M2/GDP>7%		0.25
% of government revenue)			7%>=M2/GDP		0
No legal limits on lending		0			
Terms of lending (maturity, interest, amount)	***0.2***		**Terms of lending (maturity, interest, amount)**	***0.2***	
Controlled by the bank		1	Controlled by the bank		1
Specified by the bank charter		0.67	Follow the law		0.67
Agreed between the central bank and executive		0.33	Agreed between the central bank and executive		0.33
Decided by the executive branch alone		0	Decided by the executive branch alone		0
Potential borrowers from the bank	***0.1***		**Potential borrowers from the bank**	***0.1***	
Only the central government		1	100% claim on government		1
All levels of government (state as well as central)		0.67	Claim on government> claim on private (include bank)		0.5
Those mentioned above and public enterprises		0.33	Claim on government < claim on private (include bank)		0
Public and private sector		0			
Limits on central bank lending defined in	***0.05***		**Limits on central bank lending defined in**	***0.05***	
Currency amounts		1	Currency amounts		1
Shares of central bank demand liabilities or capital		0.67	Shares of central bank demand liabilities or capital		0.67
Shares of government revenue		0.33	Shares of government revenue		0.33
Share of government expenditures		0	Share of government expenditures		0
Maturity of loans	***0.05***		**Maturity of loans**	***0.05***	

		Within 6 months		1		Within 6 months	1
		Within 1 year		0.67		Within 1 year	0.67
		More than 1 year		0.33		More than 1 year	0.33
		No mention of maturity in the law		0		Longer period by extension	0
		Interest rates on loans must be	***0.05***			**Interest rate of loans vs market rate**	***0.05***
		Above minimum rates		1		Interest on loans>market rate	1
		At market rates		0.75		Interest on loans=market rate	0.75
		Below maximum rates		0.5		Interest on loans<market rate	0.5
		Interest rate is not mentioned		0.25		Interest rate is not mentioned	0.25
		No interest on government borrowing from the central bank		0		No interest on government borrowing from the central bank	0
		Central bank prohibited from buying or selling	***0.05***			**Are there taxes for primary market transactions?**	***0.05***
		Government securities in the primary market?				Yes	1
		Yes		1		No	0
		No		0			
5	**Financial Independence**		**0.16**		**5**	**Financial Independence**	**0.16**
		Determination of the central bank's budget	***0.33***			**Determination of the central bank's budget**	***0.33***
		Mostly central bank		1		Mostly central bank	1
		Mixture of bank and executive or legislative branches		0.5		Mixture of bank and executive or legislative branches	0.5
		Mostly executive or legislative branches		0		Mostly executive or legislative branches	0

Determination of the allocation of bank profits	***0.33***	**Profit/Loss**	***0.33***
Mostly by bank or fixed by law	1	Profit	1
Mixture of bank and executive or legislative branches	0.5	Loss	0
Mostly executive or legislative branches	0		
Who is responsible for central bank losses	***0.33***	**How far the actual capital is deviated from the limit**	***0.33***
Central Bank is fully responsible	1	Higher than limit	1
At certain capital limit, government should capitalize the central bank	0.5	Less than limit	0
Government	0		

Appendix

Table A3. Details about Bank Indonesia's Legal Index

No		Description of variable	Act No 11/1953	Act No 11/1955	Act No 84/1958	Act No 13/1968	Act No 23/1999	Act No 3/2004
1		**Chief executive officer (CEO)**						
	1	**a Term of office**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**
		Term of office is 5 years Based on Act 13/1953 article 27(3): Governor and Directors shall be appointed by government on proposal of Ministry council (the so-called Dewan Moneter) for maximum 5 years. Based on Act 13/1968 article 15(3a): Governor and Directors shall be appointed by government on proposal of Ministry council (the so-called Dewan Moneter) for maximum 5 years, afterwards may be reappointed. Based on Act 23/1999 article 41(5): The member of the Board of Governors shall be appointed for 5 year term of office and may be reappointed for the same office at the maximum of one subsequent term of office. The Act 3/2004 article 41(5) is the same as the Act 23/1999 article 41(5)						
	2	**b Who appoints CEO**	**0.25**	**0.25**	**0.25**	**0.25**	**0.50**	**0.50**
		Based on the Act 23/1999 and the Act 3/2004 article 41(1): The Governor and the Senior Deputy Governor shall be nominated and appointed by the President upon the approval of Legislature. We interpret the final decision is on the hand of Legislature. Hence, the score is increased from 0.25 (based on Act 13/1953 and Act 13/1968) to 0.5 (based on Act 23/1999)						
	3	**c Dismissal**	**0.00**	**0.00**	**0.00**	**0.17**	**0.83**	**0.83**
		Based on the Act 13/1953 article 27(6): As a proposal of Dewan Moneter, governor can be dismissed by government. We assigned the lowest score since the law did not state clearly about the provision of dismissal. Based on the Act 13/1968 article 17(1,2): Governor can be dismissed before the period ends because of dead, activities causing losses, particular reason causing a bad performance, resignation. Hence, the score is increased because the law stated in detail about the provision for dismissal. Based on the Act 23/1999 article 48: Any member of the Board of Governors shall not be discharged during his/her term of office, unless it is conducted upon a resignation of such member, or upon any evidence which proves that such member have committed a crime, or permanently prevented from serving his/her office. We do not assign it the highest score 1 but 0.83 because the law still stated the provisions of dismissal, which are not related to policy.						
	4	**d May CEO hold other offices in government?**	**0.50**	**0.50**	**0.50**	**0.50**	**1.00**	**1.00**
		Based on the Act 13/1953 article 30 (2a): Governor is prohibited from having other positions unless with government's permission. It is given score, 0.5. Based on the Act 13/1968 article 18 (2,3): Governor is prohibited from having other position directly or indirectly unless with government's permission. It is also assigned score, 0.5. Based on the Act 23/1999 article 47(1): The member of the Board of Governors shall, individually or collectively, be prohibited from having any direct or indirect interests on any enterprises; holding any other position concurrently in other entities, except his/her tasks require him/her to hold such position; holding a position in the management of and or being a member of a political party. Owing to strictly prohibited from holding other positions, hence it is assigned the highest score.						
2		**Policy formulation**						
	1	**a Who formulates monetary policy?**	**0.67**	**0.67**	**0.67**	**0.67**	**1.00**	**1.00**
		Based on the Act 13/1953 article 24(3,4) and the Act 13/1968 article 9, 13: Dewan Moneter is responsible for formulating monetary policy. In case, there are conflicts in making decision, the government has a final word subject to possible protest by the governor. It can be interpreted that governor participates in policy formulation but has little influence. Hence, the score is 0.67						

		Based on the Act 23/ 1999 and the Act 3/2004 article 9(1): other parties shall not interfere with the implementation of the tasks of Bank Indonesia. It implies that policy formulation is on the hand of central bank alone						
	2	b	**Who has final word in resolution of conflict?**	**0.20**	**0.20**	**0.20**	**0.20**	**1.00**	**1.00**
		For the Act 13/1953 and the Act 13/1968, the reasons are the same as point (a) above Based on the Act 23/ 1999 and the Act 3/2004 article 43(3): The decision making of the meeting of the Board of Governors shall be taken through a deliberation to reach an agreement. If such agreement cannot be reached, the Governor shall determine the final decision. Therefore, the highest score is assigned.						
	3	c	**Role in the government's budgetary process**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
		Both the Act 13/1953 and the Act 13/1968 stated that central bank is government's cashier. For that reason, central bank has no influence. Based on the Act 23/1999 and the Act 3/2004 article 54: Bank Indonesia shall provide an opinion and consideration to the Government concerning the State Budget and other policies related to the tasks and authority of Bank Indonesia. Yet, central bank has no influence.						
3	**Objectives**			**0.40**	**0.40**	**0.40**	**0.40**	**0.60**	**0.60**
		Based on the Act 13/1953 and the Act 13/1968 article 7: The main tasks of Bank Indonesia are to maintain a stability of inflation and to create employment. Both objectives are possibly conflicting. Consequently, we assign score, 0.4. Based on the Act 23/1999 and the Act 3/2004 article 7, 8: The objective of Bank Indonesia is to maintain price stability. Moreover, Bank Indonesia also has a task to preserve financial stability by regulating and supervising banking sector. Thus, the score is increasing to 0.6.						
4	**Limitation on lending to the government**								
	1	a	**Advances (limitation on non-securitized lending)**	**0.67**	**0.67**	**0.67**	**0.00**	**1.00**	**1.00**
		Based on the Act 13/1953 Article 19(1 and 2): Central Bank has to strengthen government's budget by providing advances. The limit is 30% of government revenue. We assign score 0.67 since central bank is permitted to give advances and the limit is strict. Because of the necessities to finance a large budget deficit, in 1955, the maximum limit of credit to the government was revised by the Act 11/1955. This law stated that the maximum credit is up to the debt of government to Bank Indonesia reached 7.1 billion rupiah at the end of year 1955. The Act 11/1955 was revised again in 1958 by the Act 84/1958. Based on this law, the maximum credit to the government is 30 % of government revenue unless in the certain condition this limit is allowed maximum 50 % of government revenue. Even the maximum credit to the government increases, but the Act 11/1955 and its revisions stated a strict limitation on credits from bank Indonesia to the government. Therefore, the score given to this sub-component is 0.67. The Act 13/1968 did not state the limit of credit to the government. In Article 35 (1) just mentioned that the credit to government is based the requirement of budget. It indicates that there is no constraint for central bank to give credit for government. Hence, we assign the lowest score. Based on the Act 23/1999 and the Act 3/2004 Article 56(1): Bank Indonesia shall not provide any credit to the Government. As a result, we assigned the highest score.						
	2	b	**Securitized lending**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.67**
		Based on the Act 13/1953 Article 18(4) and the Act 13/1968 Article 36, Bank Indonesia was allowed to buy government bonds without limitation. Therefore, the lowest score is assigned. Based on the Act 23/1999 Article 55(4): Bank Indonesia shall not purchase for itself the state debt securities. It implies central bank is independent. Based on the Act 3/2004 Article 55(4): Bank Indonesia is prohibited from buying government securities on the primary market for its own account, except in the case of short-term government securities needed by Bank Indonesia for monetary control operations. It means that Bank Indonesia is permitted to buy government securities in primary market but with a strict limitation, which are only for the short-term government securities and for the emergency financing. Therefore, we assign score 0.67 for the securitized lending.						
	3	c	**Terms of lending (maturity, interest, amount)**	**0.67**	**0.67**	**0.67**	**0.33**	**1.00**	**0.33**
		Based on the Act 11/1953 Article 19: The lending to government at certain amount is not charged interest. Moreover, as mentioned above, amount of credit is limited 30% of government's revenue. Therefore, it implies that term of central bank's lending to						

		government is specified by the law. The score for this sub-component is 0.67 Based on the Act 13/1968 Article 35(3): The interest rate on lending is 3% a year, but it can be negotiated by the government and Bank Indonesia. It means that the interest rate is stated by the law but still negotiable. Hence, the score of this sub-component decreases to 0.33 Based on the Act 23/1999 Article 56(1): Bank Indonesia shall not provide any credit to the Government. We interpret that term of lending is controlled by central bank. Hence, the score is 1. Based on the Act 3/2004 Article 55(4): Bank Indonesia is allowed to buy a short term government securities in primary market. However, in Article 55(1) states that in the case Government intends to issue government securities, the Government shall hold prior consultations with Bank Indonesia. It implies that the term of lending is negotiable between central bank and government. Therefore, we assign score 0.33.						
4	**d**	**Potential borrowers from the bank**	**1.00**	**1.00**	**1.00**	**0.00**	**0.00**	**0.00**
		Based on the Act 11/1953 Article 15(1): Central government is prohibited to provide credit to other parties. On the other hand, in Article 19 states that central bank should strengthen government's budget by giving advance on demand. It implies that the potential borrower of central bank is only the government. Based on the Act 13/1968 Article 32(2): Bank Indonesia has a task as a development bank which provides a liquidity credit to public and private sectors. For this reason we assign score zero. Based on the Act 23/1999 Article 11(1): Bank Indonesia may extend credit or financing based on Syariah Principle to a Bank for a maximum period of 90 (ninety) days to overcome its short term financial difficulty (mismatch). The main problem is whether private and public sector mentioned in the questionnaire by Cukierman (1992) includes banking sector. We decided to include the banking sectors as a public and private sector category. Hence, the potential borrower based on this Act is public and private sector, which is given score zero. The same score also assigned for this sub-component based on the Law No. 3/2004.						
5	**e**	**Limits on central bank lending defined in**	**0.33**	**1.00**	**0.33**	**0.00**	**1.00**	**0.00**
		As already mentioned above, based on the Act 11/1953, there is a maximum limit of central bank credit to the government in term of %age of government revenue. Therefore, we assign score 0.33. However, the maximum amount of credit is revised by the Law No. 11/1955 in term of currency amount rather than percentage of government revenue. By this revision, this sub-component was given the highest score 1. The score is back to 0.33 since the Law No. 84/1958 stated the limit of central bank credit in term of percentage of government revenue. The Act 13/1968 did not state the limit on central bank's lending. Yet, it is mentioned that the lending is based on budget requirement. At that time, we use balance budget system, hence we decided to assign the lowest score. The Act 23/1999 stated that central bank is not allowed to give credits to government. It implies that the limit is on currency with amount is zero. Therefore, we assign the highest score. The Act 3/2004 does not mention about the limit, therefore we assign score zero.						
6	**f**	**Maturity of loans**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.67**
		For the sub-component maturity of loan, we assigned score zero for the Law No. 11/1953, the Law No. 13/1968, and the Law No. 23/1999 since these laws did not state the maturity of lending. However, because the Law No 3/2004 allowed Bank Indonesia to buy the short-run government securities, we interpret the maximum maturity of loans is 1 year. Hence, this sub-component was assigned score 0.67.						
7	**g**	**Interest rates on loans must be**	**0.25**	**0.25**	**0.25**	**0.50**	**0.25**	**0.75**
		Based on the Act 11/1953 Article 19: The lending to government at certain amount (up to 50 million rupiahs) is not charged interest. It implies, the amount of credits higher than the limit will be charged interest, yet not mentioned. Hence, we give score 0.25 for this sub-component. Meanwhile, the Law No. 13/1968 mentioned that the interest on central bank loans is 3% per year but it can be changed by Dewan Moneter conditionally. It indicates that Dewan Moneter will charge interest rate lower than market rate. By this interpretation, we assign score 0.5 for this sub-component. The score of this sub-component decreases to 0.25, since the Law No. 23/1999 did not stated about interest rate of loans. Nevertheless, based on the newest Law No. 3/2004, Bank Indonesia is permitted to buy the short-run government securities in primary market. It can be interpreted that the interest rate should be paid by the government follows market interest rate. Therefore, the score of this						

component increases to 0.75.								
8	**h**	**Central bank prohibited from buying or selling Government securities in the primary market?**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**
Based on the Act 11/1953 Article 13(4): Central bank is allowed to buy and sell securities in primary market. Hence, the score is zero Based on the Act 11/1968 Article 36(2): Central Bank can buy government's bonds. The score is also zero. Based on the Act 23/1999 Article 55(4): Central Bank shall not purchase for itself the state debt securities. Therefore, we assign score 1. Based on the Act 3/2004 Article 55(4): Central Bank may buy government securities on the primary market as part of the provision of the emergency financing facility. We assign the lowest score, zero.								
Average Index			**0.39**	**0.41**	**0.39**	**0.22**	**0.75**	**0.63**

Table B.1. Countries in Our Sample and Data Used

No.	Countries	Peak	Through	Duration	Output loss
1	Argentina	2008: II	2009:I	3	0.099
2	Australia	2008:III	2008:IV	1	0.008
3	Austria	2007:IV	2009:I	5	0.087
4	Belgium	2007:IV	2009:I	5	0.093
5	Bolivia	2008:II	2009:I	3	0.122
6	Botswana	2008:III	2009:I	2	0.281
7	Bulgaria	2008:III	2010:I	6	0.313
8	Canada	2007:IV	2009:II	6	0.034
9	Chile	2008:II	2009:III	5	0.072
10	Colombia	2008:III	2008:IV	1	0.015
11	Costa Rica	2008:I	2009:I	4	0.045
12	Czech Republic	2008:II	2009:I	3	0.098
13	Denmark	2007:IV	2010:I	9	0.104
14	Estonia	2007:IV	2010:I	9	0.256
15	Finland	2007:IV	2010:I	9	0.162
16	France	2008:I	2009:I	4	0.039
17	Georgia	2007:IV	2009:I	5	0.214
18	Germany	2008:I	2009:I	4	0.067
19	Greece	2008:III	2010:I	6	0.144
20	Hungary	2007:IV	2009:I	5	0.191
21	Iceland	2008:III	2010:I	6	0.149
22	India	2008:IV	2009:I	1	0.062
23	Indonesia	2008:III	2008:IV	1	0.036
24	Israel	2008:III	2008:IV	1	0.031
25	Italy	2008:I	2009:II	5	0.068
26	Jamaica	2007:II	2009:IV	10	0.051
27	Japan	2008:I	2009:I	4	0.086
28	Korea, Rep.	2007:IV	2009:I	5	0.125
29	Kyrgyz Republic	2008:III	2009:I	2	0.524
30	Latvia	2007:IV	2010:I	9	0.396
31	Lithuania	2008:III	2010:I	6	0.280
32	Luxembourg	2007:IV	2009:II	6	0.084
33	Malaysia	2008:III	2009:I	2	0.109
34	Mauritius	2008:IV	2009:I	1	0.116
35	Mexico	2007:IV	2009:I	5	0.118
36	Mongolia	2007:IV	2008:I	1	0.350
37	Morocco	2008:II	2008:IV	2	0.019
38	Netherlands	2008:I	2009:II	5	0.050
39	New Zealand	2007:IV	2009:I	5	0.024
40	Norway	2008:IV	2009:II	2	0.090
41	Peru	2008:II	2009:I	3	0.096
42	Poland	2008:IV	2009:I	1	0.127

43	Portugal	2007:IV	2009:I	5	0.091
44	Romania	2008:IV	2010:I	5	0.431
45	Russian Federation	2008:III	2009:I	2	0.256
46	Singapore	2008:III	2009:I	2	0.096
47	Slovak Republic	2008:III	2009:I	2	0.193
48	Slovenia	2008:II	2010:I	7	0.157
49	South Africa	2008:III	2009:II	3	0.028
50	Spain	2008:I	2009:IV	7	0.046
51	Sweden	2007:IV	2009:III	7	0.176
52	Switzerland	2008:II	2009:II	4	0.024
53	Thailand	2008:I	2009:II	5	0.099
54	Turkey	2008:III	2009:I	2	0.253
55	United Kingdom	2008:I	2009:III	6	0.062
56	United States	2008:II	2009:II	4	0.038

Source: Authors' calculations based on data provided by the IMF's International Financial Statistic (IFS)

Table B.2. List of Explanatory Variables

Variables	Definition	Sources
Labor Market Flexibility		
Minimum wage	The ratio of mandated minimum wage to the average value added per worker (2007)	Gwartney et al. (2009)
Hiring and firing regulation	Whether the hiring and firing workers is impeded by regulations or flexibly determined by employers (2007)	Gwartney et al. (2009)
Centralized collective bargaining	Whether wages are set by a centralized bargaining process or up to each individual company (2007)	Gwartney et al. (2009)
Mandated cost of hiring	Includes the cost of all social security and payroll taxes and the cost of other mandated benefits including those for retirement, sickness, health care, maternity leave, family allowance, and paid vacations and holidays associated with hiring an employee (2007)	Gwartney et al. (2009)
Mandated cost of worker dismissal	Includes the cost of the requirements for advance notice, severance payments, and penalties due when dismissing a redundant worker (2007)	Gwartney et al. (2009)
Conscription	Duration of military conscription (2007)	Gwartney et al. (2009)
Trade Integration		
Regulatory Trade Barriers	Consists of Non-tariff trade barriers and compliance cost of importing and exporting (2007)	Gwartney et al. (2009)
Exports and Imports relative to GDP	Total export plus imports of goods and services to GDP (2007)	WDI (2009)
Share of food commodities in total exports	Ratio between food exports and total exports (2007)	UN Comtrade

Share of industrial commodities in total exports	Ratio between industrial commodity exports and total exports (2007)	UN Comtrade
Share of fuel in total exports	Ratio between exports in fuel and total exports (2007)	UN Comtrade
Financial Integration		
International capital market controls	Includes foreign ownership/investment restriction and capital controls (2007).	Gwartney et al. (2009)
Domestic Financial Development		
Credit/GDP	Domestic credit to GDP (2005)	WDI (2007)
Vulnerability		
The Growth of Domestic Credit	Cumulative growth of domestic credit (2003-2005)	WDI (2007)
Quality of Institution		
Governance indicators	There are six components of governance: voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption (2007)	The Worldwide Governance Indicators (WGI)
Policy Framework		
Standard deviation of inflation	Standard deviation of the inflation rate over the last five years (2007).	Gwartney et al. (2009)
Flexible exchange rate regime dummy	The exchange rate regime on the basis of degree of flexibility and the existence of formal or informal commitments to exchange rate paths (2006)	IMF (2007)
Fiscal stimulus	The change of fiscal balance per GDP from 2008 to 2009	WDI (2009)
Population growth	The percentage change of population (2007)	IFS (2010)

Table B.3. Countries and Employment Loss

	Country	Peak	Through	Employment Loss (In Percentage)
1.	Argentina	Sept09	Dec08	0.018
2.	Australia	Mar10	Sept08	0.018
3.	Austria	Mar10	Sept08	0.034
4.	Belgium	Mar10	June08	0.016
5.	Bolivia	Dec09	Mar09	0.04
6.	Bulgaria	Mar10	Dec08	0.052
7.	Canada	Mar10	Dec07	0.032
8.	Chile	Sept09	Mar07	0.039
9.	Colombia	Mar10	Dec07	0.025
10.	Costa Rica	June09	Sept07	0.05
11.	Czech Republic	Mar10	Jun08	0.047
12.	Denmark	Mar10	Sept08	0.042
13.	Estonia	Mar10	June08	0.158
14.	Finland	Mar10	Sept08	0.037
15.	France	Dec09	Mar08	0.025
16.	Germany	Mar10	Dec08	0.014
17.	Greece	Mar10	June08	0.045
18.	Hungary	Mar10	Sept07	0.042
19.	Iceland	Mar10	Dec07	0.084
20.	Israel	Sept09	June08	0.021
21.	Italy	Mar10	Sept07	0.034
22.	Jamaica	Dec09	Dec07	0.022
23.	Japan	Sept09	Sept07	0.017
24.	Korea, Rep.	Mar10	Dec07	0.017
25.	Latvia	Mar10	Dec07	0.151
26.	Lithuania	Mar10	Sept07	0.153
27.	Luxembourg	Mar10	Sept07	0.022
28.	Malaysia	Mar09	Sept07	0.01
29.	Mauritius	Mar10	Dec08	0.022
30.	Mexico	Mar10	June07	0.044
31.	Morocco	Mar10	June09	0.02
32.	Netherlands	Mar10	Dec08	0.024
33.	New Zealand	Dec09	Sept07	0.035
34.	Norway	Mar10	Mar08	0.011
35.	Peru	Mar10	Dec09	0.024
36.	Poland	Mar10	Sept08	0.039
37.	Portugal	Mar10	June08	0.033
38.	Romania	Mar10	June08	0.045

39.	Russian Federation	Mar09	Sept08	0.035
40.	Singapore	Sept09	Sept07	0.016
41.	Slovak Republic	Mar10	June08	0.055
42.	Slovenia	Mar10	Sept08	0.042
43.	South Africa	Mar10	Sept07	0.042
44.	Spain	Mar10	June07	0.12
45.	Sweden	Mar10	Sept07	0.037
46.	Switzerland	Mar10	June08	0.02
47.	Thailand	Mar09	Dec07	0.01
48.	Turkey	Mar09	June08	0.063
49.	United Kingdom	Mar10	Dec07	0.03
50.	United States	Mar10	June07	0.06

Table C.1. List of Countries for Estimation in Chapter 4

No.	Countries	No.	Countries	No.	Countries
1	Albania	35	France	69	Mongolia
2	Argentina	36	Georgia	70	Morocco
3	Armenia	37	Germany	71	Nepal
4	Australia	38	Ghana	72	Netherlands
5	Austria	39	Greece	73	New Zealand
6	Bangladesh	40	Guatemala	74	Nicaragua
7	Barbados	41	Guyana	75	Nigeria
8	Belarus	42	Haiti	76	Norway
9	Belgium	43	Honduras	77	Pakistan
10	Belize	44	Hungary	78	Papua New Guinea
11	Bhutan	45	Iceland	79	Paraguay
12	Bolivia	46	India	80	Peru
13	Bosnia and Herzegovina	47	Indonesia	81	Philippines
14	Botswana	48	Iran, Islamic Rep.	82	Poland
15	Brazil	49	Ireland	83	Portugal
16	Bulgaria	50	Israel	84	Russian Federation
17	Burundi	51	Italy	85	Singapore
18	Canada	52	Jamaica	86	Slovak Republic
19	Cape Verde	53	Japan	87	South Africa
20	Chile	54	Jordan	88	Spain
21	China	55	Kazakhstan	89	Sri Lanka
22	Colombia	56	Kenya	90	Sweden
23	Costa Rica	57	Korea, Rep.	91	Switzerland
24	Croatia	58	Kuwait	92	Tanzania
25	Czech Republic	59	Latvia	93	Thailand
26	Denmark	60	Lebanon	94	Turkey
27	Dominican Republic	61	Lesotho	95	Uganda
28	Ecuador	62	Lithuania	96	United Kingdom
29	Egypt, Arab Rep.	63	Luxembourg	97	United States
30	El Salvador	64	Malawi	98	Uruguay
31	Estonia	65	Malaysia	99	Venezuela, RB
32	Ethiopia	66	Maldives	100	Zambia
33	Fiji	67	Mauritius	101	Zimbabwe
34	Finland	68	Mexico		

Table D.1. List of Countries for Estimation in Chapter 5

No.	Countries	No.	Countries
1	Argentina	24	Malaysia
2	Barbados	25	Mauritius
3	Bolivia	26	Morocco
4	Botswana	27	Nepal
5	Brazil	28	Nicaragua
6	Burkina Faso	29	Nigeria
7	Burundi	30	Pakistan
8	Chile	31	Panama
9	Colombia	32	Papua New Guinea
10	Costa Rica	33	Paraguay
11	Dominican Rep	34	Peru
12	Ecuador	35	Philippines
13	Egypt	36	Romania
14	El Salvador	37	Rwanda
15	Guatemala	38	Sierra Leone
16	Haiti	39	South Africa
17	Honduras	40	Sri Lanka
18	India	41	Tanzania
19	Indonesia	42	Thailand
20	Iran	43	Tunisia
21	Jordan	44	Uganda
22	Kenya	45	Venezuela
23	Mexico	46	Zambia

Samenvatting

De huidige economische crisis, gestart in de VS, heeft zich als een olievlek over de rest van de wereld verspreid. De impact van de crisis op de economie verschilt echter sterk van land tot land als gevolg van uiteenlopende gevoeligheid en kwetsbaarheid voor financiële crises, heterogeniteit in de macro-economische structuur en verschillende beleidsreacties (Berkmen et al., 2009). Hoewel diverse verklaringen zijn gegeven voor de uiteenlopende gevolgen van de crisis tussen landen, is de mogelijke rol van flexibiliteit op de arbeidsmarkt tot dusverre onderbelicht gebleven.

Een ander thema dat recent aandacht heeft gekregen is de interactie tussen monetair en begrotingsbeleid tijdens de crisis, en de implicaties hiervan voor de onafhankelijkheid van de centrale bank. Anekdotisch bewijs suggereert dat de onafhankelijkheid van de centrale bank door een financiële crisis onder druk kan komen te staan. De Argentijnse centrale bank president werd bijvoorbeeld in 2010 ontslagen, omdat hij weigerde muntreserves te verkopen om buitenlandse schulden mee af te betalen. De president van Mexico verving de centrale bank president omdat deze terughoudend was om de rente te verlagen nadat het land door de crisis was getroffen. Daarnaast hebben vele centrale banken de afgelopen jaren beleid gevoerd met een duidelijke begrotingspolitieke dimensie, zoals kredietverstrekking aan de private sector, bailouts van financiële instellingen en kwantitatieve verruiming. Volgens Sargent en Wallace (1981), Davig et al. (2011) en Davig en Leeper (2011) kan een centrale bank, zelfs als deze operationeel onafhankelijk is van de overheid, gedwongen worden zijn inflatiedoel te laten schieten om door geldcreatie de overheidsschuld te stabiliseren.

Dit proefschrift onderzoekt de impact van financiële crises op de onafhankelijkheid van de centrale bank, productie en inflatie. **Ten eerste** ontwikkelen we een de jure en een de facto index voor de onafhankelijkheid van de centrale bank van Indonesië, Bank Indonesia (BI). De eerste onderzoeksvraag die we stellen is hoe de juridische en werkelijke onafhankelijkheid van BI zich hebben ontwikkeld vanaf diens oprichting tot nu. **Ten tweede** onderzoeken we de impact van de huidige financiële crisis op productie en werkloosheid door de rol van arbeidsmarktflexibiliteit te beschouwen. **Ten derde** onderzoeken we het effect van financiële crises op de onafhankelijkheid van centrale banken. De onderzoeksvraag luidt welke invloed financiële crises hebben op de kans dat de president van een centrale bank wordt vervangen. **Tot slot** onderzoeken we wat diverse commentatoren zich tijdens de huidige financiële crisis hebben afgevraagd, namelijk: "Leiden overheidstekorten en schuldencrises tot inflatie?"

Om de onafhankelijkheid van BI te meten over de periode 1953-2009 breiden we zowel de de jure index van Cukierman (1992) als de de facto index van Cukierman (2007) uit. Bij het opstellen van de de jure index voegen we de financiële onafhankelijkheid van de centrale bank toe aan de index van Cukierman (1992). Voor de de facto index gebruiken we institutionele en economische factoren die de onafhankelijkheid van BI beïnvloeden, zoals de ontwikkeling van financiële markten, de omvang van overheidstekorten, het wisselkoersbeleid en de taak van de centrale bank als ontwikkelingsbank. Bovendien gebruiken we informatie over de achtergrond van de directieleden van de centrale bank, de vervanging van directieleden en de reden voor hun ontslag. Onze bevinding is dat er substantiële verschillen waren tussen de de jure en de defacto onafhankelijkheid van BI voor 1999. De werkelijke onafhankelijkheid van BI is vele malen groter dan in die periode juridisch was vastgelegd. Nadat Bank Indonesia middels een nieuwe wet het mandaat had gekregen van een onafhankelijke centrale bank, zijn de juridische en werkelijke onafhankelijkheid geconvergeerd door een toename in de de jure onafhankelijkheid. Bovendien vinden we dat de werkelijke onafhankelijkheid van BI significant negatief samenhangt met inflatie in Indonesië.

Ten aanzien van het tweede onderzoeksthema vinden we, met behulp van cross-sectie regressies, dat landen met lage aanstellingskosten een geringere productiedaling tijdens de huidige financiële crisis kenden dan landen met hoge aanstellingskosten. Daarentegen hebben landen met lage ontslagkosten zich langzamer herstelt van de crisis dan landen met hoge ontslagkosten. Ook handelsbarrières, openheid, groei van kredieten, financiële integratie, de stabiliteit van inflatie en bevolkingsgroei zijn van significante invloed op de productiedaling tijdens de crisis. Het herstel na de crisis wordt naast arbeidsmarktflexibiliteit beïnvloed door handelsbarrières, groei van kredieten en wisselkoersbeleid. De impact van de crisis op de werkloosheid in geïndustrialiseerde landen is geringer bij lagere aanstellingskosten, hoewel het effect betrekkelijk klein is.

Om het effect van financiële crises op de onafhankelijkheid van centrale banken te onderzoeken, gebruiken we zowel reguliere als irreguliere vervangingen van centrale bank presidenten als maatstaf voor de onafhankelijkheid van de centrale bank. Met behulp van een conditional fixed effects logit model met clusterrobuuste standaardfouten vinden we dat financiële crises de waarschijnlijkheid vergroten dat de centrale bank president wordt vervangen. Als we crises onderscheiden naar banken-, valuta- en schuldencrises, laten de resultaten zien dat alleen banken- en schuldencrises de kans vergroten dat de centrale bank president wordt vervangen. Op basis van de data van Vuletin en Zhu (2011) vinden we dat financiële crises (met name banken crises) de kans doen toenemen dat een niet-bondgenoot van de regering aangesteld zal worden als nieuwe bankpresident.

Ten slotte concluderen we op basis van de Mean Group (MG) en Pooled Mean Group (PMG) schattingsmethoden dat begrotingstekorten en schuldencrises op lange termijn een significant positief effect hebben op inflatie. De effecten zijn op lange termijn homogeen tussen landen. Ook vinden we dat de lange termijn effecten van overheidstekorten en schuldencrises op inflatie afhangen van de hoogte van inflatie en (voor schuldencrises) van politieke instabiliteit. Hoe hoger de inflatie, des te hoger zal het effect van overheidstekorten en schuldencrises zijn op de inflatie. Evenzo wordt het effect van een schuldencrisis op inflatie sterker naarmate de politieke instabiliteit toeneemt.